INCREASING INSTANCES OF SUCCESSFUL INITIATIONS OF COMMUNICATION IN CHILDREN WITH SEVERE COMMUNICATION DEFICITS USING THE PICTURE EXCHANGE COMMUNICATION SYSTEM.

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ABSTRACT

The Picture Exchange Communication System (PECS) is an intervention programme designed for use with children with autism or other severe communication deficits. Three children (two with autism and one with Down syndrome) with very limited functional communication skills were trained to use PECS, using a multiple baseline design across participants. The children were observed throughout their baseline and intervention periods and communicative forms and success of their initiations of communication were recorded. Generalisation of the training into the natural classroom setting and into the childrens' homes was measured. Due to an increase in the childrens' use of PECS as a form of communication, the children were observed to increase their frequency and success of initiating communication in their classrooms. Two of the children began using PECS at home with full support from their parents/guardians, and as a result their frequency and success of initiating communication in the home also increased. The relationship between the introduction of PECS and changes in other dependent variables, namely increased speech and improved behaviour management, are considered. Implications of the research and suggestions for future investigations are also discussed.

INTRODUCTION

Communication deficits are common to a number of developmental disorders. As Bax (1996) noted, disorders of communication (in a broad sense) are one of the most common problems faced by disability teams in the developed world. Little is known about the origin of many of these communicative disorders and as Schepis et al (1998) noted, appropriate intervention represents an area of serious concern for professionals working with these children. As noted by Stone et al (1997), communication, both verbal and non-verbal, serves a number of important developmental functions. Therefore, deficits in communication can have a disabling effect on many elements of an individual's development. Hence, the importance of determining appropriate communicative interventions for these children.

Central to a diagnosis of autism is impairment in a person's ability to communicate. According to the criteria for autistic disorder set out by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), a person must display at least one of four different communicative impairments as part of the diagnostic requirements. These impairments include the complete absence of (or a delay in) any attempt to communicate (verbally or otherwise), impairment in the ability to initiate or sustain a conversation, stereotyped language, and, the lack of make-believe or social imitative play (American Psychiatric Association, 1994). As many authors have pointed out, communicative impairments are strongly intertwined with other hallmark characteristics of autism, such as impairments in social interaction (Bondy & Frost, 1998; Butera & Haywood, 1995; Schopler & Mesibov, 1985). According to Schopler and Mesibov (1985), this link between communication and social deficits is the reason that the area of communication impairments has attracted so much interest by researchers working in the field of autism.

Many researchers (Dawson & Adams, 1984; Loveland & Landry 1986; Ohta, 1987; Sigman & Ungerer, 1984; Stone & Caro-Martinez, 1990; Stone, Ousley, Yoder, Hogan & Hepburn, 1997; Wetherby, Prizant & Hutchinson, 1998; Wetherby & Prutting, 1984;

Wetherby, Yonclas, & Bryan 1989) have compared the communicative, social, and symbolic abilities, of children with autism, to other populations. This research has identified three major areas that distinguish children with autism from their peers. The first difference is in the forms of communication used, the second is the communicative functions or purposes underlying their communicative efforts, and thirdly, autistic children show deficits in symbolism and pretend play (not seen in other populations).

Forms, or means, of communication can range from verbal methods, such as speech, to non-verbal methods such as signs and gestures. Approximately half of children with autism have some functional language skills (Cox & Mesibov 1995; Lord & Paul, 1997). However, as many authors have noted, the linguistic behaviour of these children is often peculiar, with disordered language behaviours such as echolalia, pronoun reversal, neologisms, inappropriate intonation, and primitive syntax (Lord & Paul, 1997; Ricks & Wing, 1975). Children with autism show difficulty in acquiring and using conventional forms of communication. In the early stages of language development, autistic children have been found to use more gestures and fewer vocalisations, than language-matched controls (Wetherby et al., 1998; Wetherby & Prutting, 1984). In a later investigation, Wetherby et al. (1989) found that pre-school children with autism were more likely, than other pre-linguistic children, to use gestural forms of communication in isolation, without any vocalisations. This finding was consistent with those of Loveland and Landry (1986). In a comparison of the language abilities of children with autism and those with developmental language delay (DLD), Loveland and Landry (1986) found that the children with autism performed more poorly than those with DLD on tasks involving both gesture and language. Both groups showed poor understanding of language-only tasks, and better understanding of gesture–only tasks. Unlike many other populations of children with language delays, children with autism do not compensate for their lack of verbal skills with gestures; in fact they have been shown to be limited in both the quality and quantity of gestural use. They lack the use of many attention-sharing gestures, such as showing, waving, and pointing, and use few symbolic gestures, like nodding or shaking the head; instead, they use primitive instrumental gestures such as leading, pulling, touching and taking (Loveland & Landry, 1986; Stone & Caro-Martinez, 1990;

Stone et al., 1997; Wetherby & Prutting, 1984). Loveland and Landry (1986) noted that, in contrast to the children with DLD, the children with autism, in their study, used less developmentally advanced gestural behaviours, and, the communicative intents of these behaviours were often difficult to ascertain.

Other unconventional forms of communication used by some children with autism, are physical aggression, self-injury and tantrums. Carr and Durand (1985) found evidence that these behaviours may be viewed as non-verbal means of communication, in a study involving four children (including one with autism) displaying disruptive and aggressive problem behaviours. The researchers sought to suppress the childrens' problem behaviours by teaching them to use alternative communication methods (verbal phrases) that served to elicit attention or help from an adult. In all four cases, levels of disruptive behaviour dramatically reduced after the children were trained to ask for help and attention with relevant verbal responses. Carr and Durand (1985) concluded that communication training plays an important educational role in teaching children that communication can produce reliable and positive social outcomes. In a similar study, Durand (1993) introduced functional communication training using voice output communication devices to augment communication in three children with moderate to severe mental retardation. He measured the effects of this intervention on the childrens' challenging behaviour and affect. The children were taught to use their devices in place of aggression, self-injury and tantrums, to request attention and breaks from their work. As was seen in the Carr and Durand (1985) research, the children showed reductions in their challenging behaviour following the functional communication training. Durand (1993) also observed an increase in positive affect, measured through a comparison of the levels of positive facial expressions before and after the communication intervention.

Children with autism have also been found to have a limited repertoire of communicative functions, or incentives for communicating. As noted by Bondy and Frost (1998), communicative acts commonly have reinforcing consequences. When a person communicates a request or demand for something, they are often reinforced through receiving whatever it was they asked for. Other communicative acts (for example,

answering questions or commenting on something) have consequences, such as increased attention, that are socially reinforcing. Bondy and Frost (1998) noted that the two types of consequences equally motivate normally developing children, however, autistic children are less sensitive to the social consequences of communication. There is an abundance of evidence for this in the experimental literature (Loveland & Landry, 1986; Stone et al, 1997; Wetherby, Prizant, & Hutchinson, 1998; Wetherby & Prutting, 1984; Wetherby et al 1989). Stone et al (1997) found that, when compared to control children (matched on expressive vocabulary, chronological and mental age), autistic children were more likely to communicate requests and less likely to comment. More precisely, the Stone et al (1997) results revealed that almost a third of the control children's communication was made up of commenting. In contrast, this category constituted less than 1% of the communication of the children with autism. Wetherby and Prutting (1984) found that when compared to language-matched controls, children with autism requested objects and actions more frequently, and protested more frequently than the 'normal' subjects did. These interactive acts all led to an environmental consequence as opposed to a social consequence. Commenting and showing-off (social interactive acts) occurred infrequently amongst the autistic subjects. In contrast, these social acts accounted for a significant minority (16%-36%) of the total communications of the control subjects. The aforementioned deficits in social interactive acts of commenting and showing-off are often referred to as deficits in joint attention (where two people are focussed on the same thing); this category also includes gestural acts such as pointing and showing.

As noted by Wetherby et al (1998), expressing and responding to joint attention interactions emerges in typically developing children before speech. In a longitudinal study involving children with autism, Mundy, Sigman, & Kasari (1990) found that gestural joint attention was predictive of language development 13 months later. Furthermore, none of the other non-verbal measures included in the study (mental age, chronological age, and IQ) were significant predictors of language development. This study emphasised a developmental connection between joint attention and language acquisition in children with autism. Many other researchers have also reported deficits in

joint attention displayed by children with autism (Loveland & Landry, 1986; Stone & Caro-Martinez, 1990; Wetherby & Prutting, 1984), some of whom note the possible connection between these deficits and the well-documented language deficits in autism. Loveland and Landry (1986) found that, when compared with control children with DLD matched for mental age and language, autistic children performed poorly in response to joint attention interactions. In an evaluation of their research findings, Loveland and Landry (1986) stated that language problems inherent in autism might be compounded by the childrens' developmental impairment in joint attention. In a study involving thirty children with autism, Stone and Caro-Martinez (1990) found deficits in joint attention functions that were most obvious in the subgroup of children without speech. Three quarters of the children with speech demonstrated commenting at some stage throughout the observations, and, commenting was the only joint attention function to be used by the non-verbal children in this study (the other two joint attention categories in this study were giving information and seeking information). Hence, Stone and Caro-Martinez (1990) suggested that commenting might be the earliest joint attention function to develop. Keeping in mind the results of research in this area, it is fair to say that the limited range of communicative functions characteristic of children with autism, may be a fundamental impairment of the disorder.

The third distinguishing feature apparent in children with autism is their limited ability to develop symbolic or pretend play. Research involving children with autism has shown significant deficits in symbolic play (for example, pretending a block of wood is a car, driving it around, filling it with petrol, and racing it with other 'cars') and in functional play (where objects, such as a doll or toy telephone, are used functionally) (Sigman & Ungerer, 1984; Wetherby & Prutting, 1984; Wetherby et al, 1998). In a small study (with a total of eight participants) comparing autistic children with language-matched controls, Wetherby and Prutting (1984) found that children with autism performed significantly poorer in areas of pretend play. In contrast, performance in constructive play (for example, stacking blocks and making puzzles) was comparably higher than that of the control group. Wetherby et al (1998) conducted a similar but larger study involving two groups of participants, one group consisted of 22 children with a diagnosis of autism or

pervasive developmental disorder (PDD), and the other group was made up of 22 children with DLD. Their findings were consistent with those of Wetherby and Prutting (1984); the autistic/PDD group demonstrated relative weakness in pretend play and relative strength in constructive play.

Symbolic ability is also required in the use of labelling and language in general because words are used to symbolise objects and activities. Evidence for this came from Wetherby and Prutting (1984), they found that in comparison to language-matched controls, the autistic group was deficient in their ability to comprehend verbal labels and imitate words and gestures. Furthermore, deficits in functional and symbolic play were significantly correlated with deficits in receptive and expressive language. Wetherby and Prutting (1984) suggested a possible explanation for the strengths and weaknesses in different areas of symbolism and play seen in the autistic population. That is, the areas of strength were in skills that can be learned through trial-and-error, while the areas where children with autism tend to show weakness are in activities that need to be learnt through observational learning and imitation. Sigman, Dissanayake, Arbelle, and Ruskin (1997) noted that imitation, or modelling, is frequently used in many areas of learning by typically developing children.

Problems with imitation skills in people with autism are well documented in the literature (Dawson & Adams, 1984; Ohta, 1987; Sigman & Ungerer, 1984; Wetherby & Prutting, 1984). Deficits in attention and imitation (precursors to the development of communication in normally developing children) are often described as some of the earliest signs of autism (Butera & Haywood, 1995; Prior & Ozonoff, 1998). Researchers have found deficiencies in imitation apparent from the first year of a child's life, when the simple imitative games, such as "peek-a-boo", do not appear (Klin, 1992; Prior, Perry, & Gajzago, 1975). Comparative studies involving children with autism, from a range of different ages, have reported autism-specific imitation deficits that involve behaviours from vocal imitation through to the imitation of body movements and manipulation of objects (Dawson & Adams, 1984; Ohta, 1987; Sigman & Ungerer, 1984; Wetherby & Prutting, 1984). As a number of authors have noted (Butera & Haywood,

1995; Smith and Bryson 1994) the aetiology of these imitation difficulties in autism is relatively unclear.

There is general consensus that teaching non-verbal children with autism to communicate, should be a major focus for intervention programmes. However, different intervention approaches vary greatly, and, the debate over which approach is most effective, at providing functional communication for children with autism, has not been resolved. As a number of authors have noted (Harris & Boyle, 1985; Hartung, 1970), training an autistic child to use formal language as a means of communication requires the child to have (or acquire) a number of preliminary skills. These skills include attending, verbal imitation, and non-verbal imitation, all of which are deficient in children with autism. The actual teaching of functional speech (including the sounds that form different words and the words' meanings) comes a long way down the track. Harris and Boyle (1985) noted the importance of each of these preliminary skills in preparation for speech training. Firstly, a child must be able to attend to the person teaching them, in order to comprehend and learn the material being taught. Secondly, non-verbal imitation is taught in order for the child to learn to relate his or her body movements to those of the teacher. Fine movements of the mouth and tongue may also be taught at this stage in order to facilitate the third stage. This final 'building block' stage, verbal imitation, is taught through gradual shaping of vocalisations made by the child until they resemble the sounds modelled by the trainer. It is necessary for the child to learn to imitate sounds in order for them to learn to put sounds together to form words. All of this preliminary training is of minimal value to the child, and, prior to the actual functional speech training, they would not have experienced any intrinsic reinforcement from their communication intervention programme. Because it is necessary to teach the child to attend and imitate before actual language training, the process of teaching autistic children to use speech as a means of communication is often long and arduous. On a more positive note, when these training approaches are effective, dramatic improvements have been reported (for example Lovass, 1987). However, as Bondy and Frost (1998) noted, a significant limitation with this type of communication training is that the children are often dependent upon prompts from trainers and cannot initiate interactions

themselves. Problems with generalisation of this training into the childrens' natural environments has also been noted (National Research Council, 2001).

The National Research Council (2001) reported empirical support for naturalistic teaching of speech, language, and communication. Researchers (Charlop, Schreibman, & Thibodeau, 1985; Charlop & Trasowech, 1991; Matson, Sevin, Fridley, & Love, 1990) carried out this type of communication training in the natural environments of the children. They attempted to increase spontaneous initiations (through methods such as time delay prompting), and used natural reinforcers following what the child was trying to communicate. Although these more contemporary behavioural approaches might overcome difficulties of prompt dependency and generalisation, they still require the children to learn through modelling and imitation. As noted by Anderson, Taras, and Cannon (1996), teaching "readiness skills", such as attending to the trainer and imitating motor movements, takes up the first several months of training; and, during this time the child receives very little intrinsic reinforcement.

As Carr, Binkoff, Kologinsky and Eddy (1978) noted, "many autistic children do not acquire verbal skills despite intensive training efforts" (p489). For this reason, and the aforementioned issues associated with teaching autistic children to use speech to communicate, there has been growing interest in using various alternative or augmentative communication (AAC) interventions. As Parker (1996) noted, it is important to keep in mind that the goal of any AAC intervention programme is to increase communication, and, an increase in communication usually leads to an increase in speech. Mirenda and Erickson (2000) noted that one of the most common concerns expressed by parents, who are considering implementing an AAC programme with their autistic child, is that the programme might have detrimental affects on speech development. Research in the area of AAC has found this concern to be unwarranted; in fact, many researchers have reported increases in speech after the introduction of alternative communication systems (Bondy & Frost, 1994; Yoder & Layton, 1988).

There are a number of different AAC interventions used in the field of autism and DLD, including manual sign language, computerised devices, communication boards and communication books. As Harris (1995) noted, sign language was the primary augmentative intervention used for teaching communication to non-verbal children with autism. Manual signing was often combined with speech (this was referred to as simultaneous or total communication), and researchers (Barrera & Sulzer-Azaroff, 1983; Yoder & Layton, 1988) found that this combination, rather than either sign or speech in isolation, facilitated more child-initiated speech. In research aiming to teach children with autism to use signs (rather than attempting to teach speech), Remington and Clark (1983) compared the effectiveness of the aforementioned teaching methods - simultaneous communication (signs and speech) and sign training without speech. In the simultaneous training condition signs were accompanied by the corresponding verbal label, in the sign-alone training condition no verbal labels were used; results showed no differences in acquisition speed between the two teaching methods. Because the accompanying speech does not hinder the acquisition of signs, and may help with speech acquisition, the simultaneous training method is used more often than the non-verbal training method.

Just as speech training is more functionally beneficial when it is taught using a more naturalistic approach, so too it seems is the training of manual signs (e.g., Carr & Kologinsky 1983). In an early study, Carr and his colleagues used a highly structured teaching situation with massed training trials, and, although they showed that the autistic subjects could learn a number of different sign labels, the children were unable to generalise their training to other situations, therefore the training was of little functional benefit in terms of improved communicative ability (Carr, Binkoff, Kologinsky, & Eddy, 1978). Using more naturalistic incidental techniques to teach a group of children with autism to use their sign repertoire, Carr and Kologinsky (1983) observed increased spontaneous requesting using signs, and generalisation across settings and adults. Techniques used by Carr and Kologinsky (1983) include things such as making a desirable object visible but just out of reach so the child needs to use sign to request it, and incorporating communicative opportunities into daily activities. Due to the existing

sign repertoires of the children in the Carr and Kologinsky (1983) study, only brief teaching sessions were required, outside of the natural environment, to help them master the signs. For children who are just beginning to learn sign as a means of communicating, these teaching sessions would need to be more elaborate. Further evidence for the efficacy of training in the natural environment came from Horner and Budd (1985), in their attempts to train a young boy with autism to use manual signs to communicate his wants and needs. Initially the training sessions took place in a corner of the classroom; however, the training did not generalise at all to other situations. When the teaching environment was changed and the boy's training was delivered in more natural situations, he began to use the signs outside of formal training.

A potential advantage of sign over speech, as noted by Bondy and Frost (1998), is "that visual cues may not be as transitory as vocal cues" (p 376). However, as Harris (1995) stated, this system often proves difficult for young children to master. Mirenda and Erikson (2000) noted that unlike visual-graphic symbols such as photographs which bear a strong resemblance to their referents, manual signs often display a weak resemblance, making them difficult to learn and remember. Evidence for this connection between symbol representativeness and symbol learnability was reported by Fuller and Stratton (1991). Also, the difficulty with imitation and attention is not overcome with this system - the child must attend to the trainer and be able to imitate the signs in order to learn them and use them independently. In a study involving two groups of children with autism, one group with good verbal imitation skills and the other with poor verbal imitation, Layton (1988) reported fewer communication gains in the latter group following language training using different combinations of sign and speech.

Furthermore, even if the child does learn to use manual signs to communicate, they are limited with respect to the people who will be able to understand them. Communication partners who are not familiar with the particular sign language that the child has learnt will need an interpreter to be able to understand what the child is communicating. Evidence for this came from a study carried out by Rotholz, Berkowitz, and Burberry (1989). These researchers compared the functionality of two alternative modes of

communication with unfamiliar people from the community. The modes included signing, and using a communication book containing picture symbols. Two adolescents with autism were taught to use both modes of communication to order food from a restaurant. The understanding from the communicative partners in the restaurants when the adolescents were using sign averaged between 0% and 25% for the first student and 0% for the second student. When using the picture symbols, the understanding rates averaged between 80% and 88% for the first student and between 95% and 100% for the second. Therefore, as Harris (1995) concluded, learning to use manual signs does little to integrate the person with autism into the general community.

There are a number of computerised AAC systems, designed to assist people with their communication; one such system is a voice output communication aide (VOCA). A VOCA is a portable device that stores synthesised or digitised speech. Recorded messages are accessed through touching particular symbols, words, or letters on the VOCA display (for example, if the play symbol is activated, the VOCA might say "play" or "I want to play"). Mirenda and Erickson (2000) explained that there are three types of VOCAs, ranging from the relatively simple single-level VOCAs through to the more complex comprehensive VOCAs. Single-level VOCAs can usually store a limit of 20 messages at a time which can simply be changed (recorded over) if and when the need arises. Multi-level VOCA devices are more complex and difficult to programme; they have the capacity to carry thousands of messages on multiple levels. The very highly sophisticated VOCAs, referred to by Mirenda and Erickson (2000) as comprehensive VOCAs, have (as they explained) the capacity to store complex multiple messages and the ability to operate with standard personal computers. Another VOCA device, described by the National Research Council (2001), is called a dynamic display device, in which a child points to a symbol such as "toys" and a "toy specific" board appears on the VOCA display so the child can then interact within that specific context.

Research documenting the efficacy of VOCA systems as a means of communication has shown positive results. Schepis, Reid, and Behrman (1996) evaluated the acquisition and functional use of voice output communication in three adults with profound mental and

physical impairments and reported the effective use of the VOCA in a number of different settings. Furthermore, people who were unfamiliar with the participants reported in a survey that they could better understand the participants when they were using their VOCAs. In a study involving two non-verbal children with developmental delays, DiCarlo and Banajee (2000) reported increases in communicative initiations when the children were trained to use a VOCAs labelled with Picture Communication Symbols.

As Mirenda and Erickson (2000) noted, the vast majority of research in this area has been with students who have disabilities other than autism, however one study that was specific to children with autism was that of Schepis, Reid, Behrman, and Sutton (1998). The participants in the Schepis et al (1998) study were four children with autism, all of whom had the ability to discriminate between picture symbols, imitate simple sounds and respond to one-step requests such as "come here". Initiations of communication were rare, as were communicative vocalisations. Schepis et al (1998) made use of a VOCA called 'Cheap Talk', which they introduced into two settings, snack and play. They used modelling techniques (in the naturalistic setting) to encourage the children to communicate using the VOCAs. Schepis et al (1998) reported increased rates of communication using VOCAs for all four children; however, these communications were only possible in the set times that they had access to the VOCAs. As Schepis et al (1998) noted, extended use of the VOCAs may lead to problems, such as the portability of the device across routines and settings. These issues might be resolved with the use of more complex multi-level VOCAs that have the capacity to store a lot more messages. However, problems with these electronic devices might also appear, e.g. in particular situations, such as water-based recreation, where they could potentially get damaged. Furthermore, as Worth (2001) noted, VOCAs are very expensive in terms of their initial outlay and they also require the communicator to be able to type words, understand written language, or at least discriminate between pictures. The limited research in this area with autistic subjects relies on teaching methods (i.e., modelling) that require the preliminary skills of attending and imitation; making further research involving children with autism that have not already acquired these skills necessary. These difficulties aside, as with sign language, the visual cues present when using VOCAs are less

transitory than the auditory cues of speech, and, the problems of representativeness seen in many sign systems are avoided with VOCAs because they use less ambiguous symbols such as pictures and words that bear close resemblance to their referents.

Another AAC system that has recently been explored is the use of communication boards containing picture symbols, such as photographs or line drawings. Most of these systems involve the child pointing to relevant pictures and thus communicating messages. For example, if a child, using this system, points to a symbol depicting an apple, the teacher interprets this action as communicative and assumes that the child wants an apple. However, as Bondy and Frost (1998) mentioned, in order to use the communication boards the child must be able to recognise that a particular symbol on the board represents a particular object or activity. Therefore, prior to any training where the child points to a picture and is intrinsically reinforced for doing so, they must be trained in the prerequisite skill of matching an object with the symbol that represents it. As Bondy and Frost (1998) explained, initially the child is trained in object-to-object matching (matching apples with apples and so forth), and then in object-to-symbol matching (matching a picture of an apple with a real apple). This training is minimally motivating for the child and involves extrinsic reinforcers that are selected by the teacher. Bondy and Frost (1995, 1998) also duly noted another problem with this picture pointing system, namely that the child is only able to communicate when a teacher or another adult notices that they are pointing to a picture, therefore the child is unable to initiate communication. Child-initiated communication is also not encouraged by the teaching process often used with this type of programme. For example, a typical communicative interaction using this pointing system consists of a teacher bringing a child their communication board and asking them "what do you want?" requiring the child to select the desired item from a selection of symbols. Thus, Bondy and Frost (1998) concluded, it is the teacher rather than the child who leads the interaction so the child does not learn to communicate spontaneously in a social context without a direct prompt. Finally, Bondy and Frost (1998) noted that there is also the problem of inaccurate pointing, where a child might touch a communication board displaying a variety of symbols with their entire hand, or run their finger over a number of different pictures, forcing the teacher to 'guess' exactly

which symbol they were trying to touch. Research discussed earlier provided evidence that children with autism have difficulty with pointing (and other distal gestures), therefore, as the National Research Council (2001) suggested, these children might benefit more from a communication system requiring them to *give* the selected symbol to the communicative partner (in exchange for something) rather than a pointing system.

According to the National Research Council (2001), the most widely used AAC exchange system is the picture exchange communication system (PECS); (Bondy and Frost, 1994a) which teaches children to exchange symbols as a form of communication. Bondy and Frost (1995) noted that PECS does not try to teach prerequisite skills such as imitation and labelling (unlike many other interventions), as these have socially based reinforcers; instead, the first skill taught is requesting, which is maintained by specific (usually tangible) reinforcers. This initial emphasis on requesting is supported by the studies mentioned earlier (Loveland & Landry, 1986; Stone et al, 1997; Wetherby et al, 1998; Wetherby & Prutting, 1984; Wetherby et al 1989), in which researchers found high rates of requesting and low rates of commenting amongst groups of children with autism. As Bondy and Frost (1994a) noted, because the training is begun with functional acts that result in intrinsic reinforcement for the child, the initial step of any PECS programme, before training is begun, is to discover things that the child wants. This is done through a process called a reinforcer assessment. During a reinforcer assessment the child is presented with different items (edibles and toys) and their preferences (the items they reach for) are recorded, this process helps the trainers discover items that are highly preferred through to those that are non-preferred. Conducting reinforcer assessments on a regular basis throughout a child's training ensures that the reinforcers being offered are always highly reinforcing for the child, thus increasing the likelihood that the communicative behaviour will reoccur. As noted by Bondy and Frost (1995), potential social reinforcers such and smiling and verbal praise are delivered along with the tangible reinforcers, and might eventually act as effective reinforcers themselves.

During the first phase of PECS training the child (sitting in a chair facing their communicative partner) is taught to request a highly preferred item using a picture card.

The child is shown the desired item but direct prompts from the communicative partner, such as asking them if they want it or pointing to the picture card, are avoided. Thus, encouraging the child to spontaneously initiate communication, rather than just respond to teacher-initiated interactions. In research involving thirty children with autism, Stone and Caro-Martinez (1990) revealed that spontaneous communication rarely occurred. On average, these children initiated communication only three to four times an hour. In response to their findings, Stone and Caro-Martinez (1990) noted their support for programmes (such as PECS) that teach functional communication skills. In order for the child to learn to pick up and pass the picture card in exchange for the item without being prompted by the communicative partner, a second trainer is necessary. This person sits behind the child and waits for them to reach for the item, at that exact moment the prompter takes the child's hand and physically directs them to complete the exchange; assistance is faded out as quickly as possible. As noted by Bondy and Frost (1998), this strategy is similar to the peripheral physical prompting strategy used with autistic children in the Macduff, Krantz, and McClannahan (1993) study. An advantage with this two-person system, as noted by Bondy and Frost (1998), is that it helps to prevent prompt dependency, and encourages spontaneity.

This leads directly to the second phase of training, entitled "expanding spontaneity" (Bondy and Frost, 1994a). Bondy and Frost (1998) noted that during this phase, spontaneity is strengthened in a variety of ways. Cues from the communicative partner, such as facial or hand cues, are faded, also the distance between the card, the communicative partner, and the child is gradually increased. Generalisation is also focussed on during this phase by training the child with a number of different communicative partners, with a variety of cards, and across environments. By the end of this phase, the child has learned to be a persistent communicator, approaching a communicative partner and giving them the card even when their back is turned or they are in another room.

Phase three teaches the child to discriminate between picture cards. This enables the child to select the card that corresponds to the item they desire, when the card is amongst

a number of others. Training begins with a highly desired item being paired with a non-preferred or neutral item (such as a sock), and moves on until the child can discriminate between many equally desirable items. Accuracy of the child's selection is measured using what Bondy and Frost (1994) refer to as "correspondence checks", which simply determine whether or not the child knows what they asked for (a choice of items, including the one matching the card given by the child, are held out to them and they are told to "take it"). Bondy and Frost (1994a) suggest a number of other strategies for teaching discrimination if the child displays difficulty with learning this phase, noting that there are a number of different strategies and that no single method is best for all children.

In the final three stages of PECS training, the child is gradually introduced to the communicative function broadly referred to as commenting. Bondy and Frost (1998, 2001) noted that when a typically developing child uses a single word utterance to request or comment, the intonation and gestures accompanying their speech enables the communicative partner to determine whether the child wants the item or if they are merely commenting on it. However, when using pictures to communicate, additional cues must be present in order for the communicative partner to know whether the child is commenting or requesting. Studies discussed earlier (Loveland & Landry, 1986; Stone & Caro-Martinez, 1990; Wetherby & Prutting, 1984) reported deficits in joint attention displayed by children with autism, including deficits in gestural joint attention (e.g., pointing). Hence, children with autism who are using PECS are unlikely to use accompanying gestures that cue the communicative partner as to whether they are requesting or commenting. For this reason, PECS teaches the child to make sentences (on a sentence strip) using one of three icon-phrases. When requesting the child is taught to use an "I want" card in addition to the specific item card. When commenting the child uses cards such as "I see" or "It's a". The sentence strip is introduced gradually, and initially the training is restricted to requesting and the child is taught to use the "I want" card. As Bondy and Frost (1998) noted, introducing two concepts at once (i.e., a new communicative function and the use of an icon-phrase) would probably be too overwhelming for the child.

During the next phase, the child is taught, using delayed prompt procedures, to answer the question "what do you want?" Charlop and Trasowech (1991) found empirical support for this time delay approach in a study that used this procedure to increase spontaneous speech in three children with autism. Once the child is successfully responding to the cue asking them what they want, questions like "what do you see?" and "what do you have?" are introduced. All of the questions are used interchangeably and the answers are appropriately responded to with tangible and/or social reinforcers. Time delay procedures are used throughout, and prompts are faded to encourage spontaneous commenting. As Bondy and Frost (1998, 2001) noted, high rates of spontaneous requesting are maintained throughout the later stages of PECS training. The PECS manual (Bondy and Frost, 1994a) suggests techniques such as the use of "surprises" to promote spontaneous commenting; for example, having a bag full of objects and pulling them out one at a time, initially with a cue such as "Oh! (with a surprised expression) What do you see?" and slowly fading out the verbal prompt.

Additional vocabulary such as shapes, colours, and size are taught by incorporating them into already existing functions e.g., a child is taught to ask for a round biscuit, a red pebble, or a big drink. This involves the introduction of new icons representing the various shapes, colours, and the like. Bondy and Frost (1998, 2001) noted that such skills are traditionally taught with receptive tasks for example, asking the child to "touch red" or "point to triangle", and they noted the difficulty students often have learning these concepts in this manner. Other communication skills such as answering yes-no questions and asking for assistance or a break from an activity when they need it are also taught throughout the last two phases of PECS training. The importance of having a functional means to ask for help or breaks from their work, was clearly demonstrated in research described earlier (Carr & Durand, 1985; Durand, 1993). These researchers observed dramatic reductions in disruptive behaviour shown by children with autism after they had been trained to request things such as help or breaks.

Mirenda and Erickson (2000) noted that just as disruptive behaviour in children with autism can be reduced through the introduction of *expressive* support, introducing more effective *receptive* communication can have a similar reductive effect on challenging behaviour. Bondy and Frost (2001) noted that children with autistic spectrum disorder (ASD) often have difficulty with transitions both within and between tasks. As Mirenda and Erickson (2000) explained, picture communication symbols (PCS) have been used in the form of a schedule of activities. These "symbol scripts" help to clarify the exact order of activities (or tasks within an activity) and assist children with ASD in following them. Dooley, Wilczenski, and Torem (2001) implemented a pictorial schedule programme (using PECS) with a young boy with pervasive developmental disorder (PDD). They observed a dramatic reduction in disruptive behaviour and an increase in compliance during transitions, following the PECS intervention.

Much of the PECS outcome data reported in the literature is from children in the Delaware Autistic Programme (DAP). The DAP, as described by Bondy and Frost (1995), is a full-year public school programme that accommodates educationally classified students with autism, ranging in age from birth to 21 years. The student-to-staff ratio is high and the staff includes specialists such as Psychologists and Speech and Language Therapists (SLTs). Bondy and Frost (1995) stated that "over 80% [of the children in the DAP] functioned in the retarded range" (p. 312), and of the children who entered the programme prior to the age of five, more than 80% had no functional speech.

Bondy and Frost (1994b) reported PECS outcomes for 85 children who were taught to use PECS as their initial means of communication. All of these children entered the DAP without any functional means of communication and their intellectual levels ranged from near normal to profoundly delayed. They all lived with their parents or guardians and entered the programme by the age of five. Bondy and Frost (1994b) reported that almost all of these children learned the basic exchange (of at least one picture) within the first month of training. Data, up until the report was written, showed that, of the children who stayed with the programme for more than a month, 29% were using a combination of speech and pictures, and 48% were using speech exclusively. For those children in the

programme who used PECS for over a year, 59% acquired speech and used it without any augmented communication. Bondy and Frost (1994b) noted that overall, 76% of children placed on PECS came to use it alongside speech or learnt (through PECS) to use speech exclusively. The children who continued to depend solely on PECS to communicate generally functioned at a level of profound intellectual disability.

Furthermore, Bondy and Frost (1995) noted that improvements in communication skills were positively correlated with improvements in various behaviour management problems and idiosyncrasies associated with autism, as measured by the Autism Behaviour Checklist (ABC). Children who depended solely upon the picture-based system to communicate showed slight improvements in their ABC scores while those who used a combination of pictures and speech displayed modest improvements. Dramatic reductions were reported by Bondy and Frost (1995) in the ABC scores of the children who learned (through PECS training) to use speech as their sole means of communication. As the authors noted, these correlations do not prove a causal relationship between the development of speech through PECS and reductions in problematic and idiosyncratic behaviour of children with autism, however, the outcomes are encouraging. Overall, the outcome data from students in the DAP who were taught to use PECS to communicate, looks very promising and desirable outcomes such as increased communication, development of speech, and reductions in problematic behaviours have all been reported. However, this data was not collected in an experimental manner as there were no controls (e.g., children who were not trained to use PECS, nor baseline measures of each child's communication prior to the introduction of PECS) against which to measure changes in communication. Therefore, the researchers could only speculate that it was the introduction of PECS, and not some other variable in the childrens' lives, that lead to the improvements in communicative skills.

Liddle (2001) reported outcome data from another school setting where PECS was introduced to a total of 21 children (with autism and other severe learning difficulties) who had little or no functional language. The children were formerly trained by the school's SLT once a week and PECS was also used in the classrooms. Liddle (2001) did

not specify whether or not classroom teachers, or other staff, were included in any of these formal training sessions. At the time the report was written, the children had been trained in the use of PECS for 10 to 11 months on average. Results showed that 20 of the 21 children learned to use PECS to request desired items. Of these 20 children, 55% (11 children) were using sentence strips for requesting and of these 11, 72% were sequencing up to four icons and symbols to request and comment. The remaining children all showed increases in initiating communication through requesting. Liddle (2001) noted, in reference to parents and teacher reports, that 42% of the children increased their attempts at spoken language, and 33% were using single words. One child was reportedly using sentences combined with PECS symbols. However, as Liddle (2001) noted, no controls were used; therefore although the data appear promising, the experimental validity of the research is questionable.

To my knowledge, the only other published study looking at the communicative outcomes of PECS training, is that of Schwartz and Garfinkle (1998). These researchers completed two studies. The first examined the rate at which PECS was acquired, and the second looked at the overall effects of PECS on communicative abilities. Thirty-one children with developmental disorders including Autism, Pervasive Developmental Disorder - Not Otherwise Specified (PDD-NOS), and Down syndrome, were included in the first study, while eighteen of these children made up the participants in the second study. The participants ranged in age from 3 to 6 years and all had severe delays in communication. The PECS interventions occurred in the children's classrooms, which included 14 other children, 9 with developmental disabilities and 6 typically developing children. Data was collected from the children's Individualised Education Plan (IEP) data books. These books contained previously recorded data about each individual's progress through the PECS programme, recorded by classroom staff including teachers and SLTs. All 31 children learned to use PECS to communicate with adults and peers. On average, the children took 2 months (ranging from 1-5 months) to master the first phase of training (passing a symbol in exchange for an item or activity). The second phase, distance and persistence, was acquired at a similar rate (ranging from 1-6 months). Teaching discrimination took a little more time than the first two phases; the average

amount of training needed was three months (ranging from 1-6 months). The fourth phase, using sentence strips to request, took an additional 1 to 9 months of training (3 months on average). Schwartz and Garfinkle (1998) did not report past this phase of training. The next step in these children's training consisted of teaching them to use their PECS to communicate not only with adults but also with their peers and this took, on average, a further 3 months (range 1-12 months). In summing up their findings, Schwartz and Garfinkle (1998) stated that it took the children in their study 11 months, on average, to master the basic PECS protocol.

The data for Schwartz and Garfinkle's second study (1998) was collected via direct observations of each child on three separate occasions, over a two-year period. Observers recorded communicative functions (such as requests, protests, or comments) and forms (including PECS exchanges and verbalisations). Results from this second study revealed that 44% of the children developed speech after learning PECS. In fact, Schwartz and Garfinkle (1998) noted that this group of children stopped using PECS altogether and were communicating exclusively with speech. The other 56% acquired little speech but continued to use PECS to communicate. Schwartz and Garfinkle (1998) also reported some impressive generalisation. The children not only generalised their PECS training to other environments and people, they were observed to use different communicative functions such as commenting (which they were never formally taught).

In the Schwartz and Garfinkle (1998) studies, acquisition of the PECS system proved to be relatively fast and efficient and the communication skills were shown to generalise from the training setting to other situations. However, the designs of these studies were less than adequate. The data collected was not experimental data, but rather, programme evaluation data, therefore, as Schwartz and Garfinkle (1998) noted, the research is limited in that it cannot pinpoint the cause of the growth in communicative behaviour shown by the children in their study. Also, no baseline measures of communication were recorded prior to the PECS intervention and, although the results reported generalisation of PECS training to other settings, this was not systematically measured.

The purpose of the present research is to use a single subject, multiple baseline design, to evaluate the effectiveness of PECS at increasing instances of successful initiations of communication, in three children with severe communication difficulties. Extending prior research, it will measure the generalisability of PECS training to other settings, and provide evidence of a causal link between PECS training and improved communication (in particular, initiating communication).

METHOD

Participants and setting

Three five and six year old children, two with autism and one with Down syndrome (also described by parents and teachers as having "autistic symptoms"), were trained to use PECS, up to and including phase three (the discrimination phase). Joshua was diagnosed with autism at age two and a half, and prior to this research he had had some limited experience with picture communication at Kindergarten. Jane was also diagnosed with autism at two and a half and her prior communication training involved some sign language and the use of picture schedules at school. Adam with Down Syndrome, had had some experience with PECS at pre-school but was not using it at all, either at school or at home. The three participating children were selected from a special needs unit at a Christchurch school based on certain criteria. The first was that they had very limited functional language with little if any initiation of communication (verbal or otherwise), and secondly, the children were to have autism or display autistic tendencies. Written consent was obtained from the school and from each child's parents prior to any training or observation of the children (see Appendix A). Parents were free to withdraw from the project at any time (Appendix B).[1]

The training took place at the children's usual learning centre, which they attend five days a week. The children were trained to use PECS four mornings a week. Training times differed slightly for each child, as the training was individual rather than group-

[1] The University of Canterbury Human Ethics Committee granted approval for the research.

based. Initially the training took place in a small room, approximately two and a half metres square, located at the back of the classroom. The room had a door and a gate that could be closed in order to shut out visual and auditory distractions. The PECS training sessions were gradually moved into the natural classroom environment. Jane was in a class with three other children, which had one teacher and one teacher aide at all times. Joshua and Adam were in another class of seven children, with one or two teachers and two teacher aides.

Materials

The PECS symbols used during training and in the classroom and homes were from a number of different sources. The majority were black and white symbols taken from the Picture Communication Symbols (PCSs) combination book (Johnson, 1994). Those symbols that were not available in this book were either photographed or hand drawn to similar dimensions. Some specific items, such as a particular type of yoghurt, were photographed and used as symbols to assist discrimination. For most of the training the symbols were on 5cm square cards. Larger symbols, on 10cm square cards, were substituted for the highly preferred symbols for two of the children to try to increase accurate discrimination.

Each child had their own PECS folder that contained cards for their preferred items and activities. The folders (standard A4 sized with flexible plastic covers) were cut to a manageable size, approximately 21cm high and 26cm wide, with a longer base than top cover (see diagram, Appendix C). The large base allowed room for a sentence strip to be attached for the later phases of the childrens' PECS training. Velcro strips were attached to the top covers of the folders, and to a number of cardboard pages slotted inside them. A separate set of cards was supplied for the children's homes. Initially, to avoid confusion, they only had one card at home and the number increased as they began to discriminate between cards. Because of the small number of cards in the home environment, the folders stayed at school and the cards were attached to the family fridge or a communication board.

The training strictly followed the recommendations and instructions set out in Bondy and Frosts' *PECS Training Manual* and its updates (Bondy & Frost, 1992, 1994, 1995, 1996). After speaking to parents and teachers about possible reinforcers for each of the children, a reinforcer assessment was carried out, in line with Bondy and Frost (1994). Highly preferred items included edibles, such as jellybeans, cheese balls, raisins, chips, chocolate, milky bars, and pretzels. Toys and activities were also included in the reinforcer assessments, and highly preferred items included bubbles, jingle balls, ribbons, play dough, string, and flash cards.

Procedures

Design

A multiple baseline across participants was used. Adam had the shortest baseline of three days, this allowed for three observations in total, two in the school environment and one in the home. Jane was the second participant to begin her PECS intervention, 6 days later. Jane's baseline measures included four in the school environment and one at home. Joshua's baseline continued for a further 6 days before his PECS training began. Joshua was observed in baseline a total of seven times, five at school and two at home. The baseline and intervention went for a total of ten weeks (the last term of the 2001 school year).

Observations

During the baseline and intervention periods, the participants were observed in both their school and home environments. Instances of initiating communication, the methods used, and whether or not the communicative attempts were successful, were recorded during the observation periods. The purpose of observing the children at home as well as in their training environment, was to permit assessment of generalisation across environments and different communicative partners.

Initiations were recorded as successful if the communicative partner gave the child what s/he thought the child was asking for, and the child stopped trying to communicate. If the

child continued to attempt communication (for example, continued to pull or vocalise) after the communicative partner had tried to give them what they thought they were asking for, then the communicative attempt was recorded as unsuccessful. It was a judgement call from the observer (watching the child's reaction) as to whether or not the child had successfully communicated what they wanted. Initiations of communication were recorded under one of four categories, similar to those in the Schwartz and Garfinkle (1998) studies. The communicative initiation categories included, gestures, vocalisations, verbalisations, and PECS exchanges. The 'gestures' category incorporated body movements such as pointing, facial expressions, and pushing or pulling on someone else. Communicative initiations were recorded as vocalisations when the child made sounds that could not be interpreted as conventional language, for instance, grunting, screaming, and crying. When the child used words that had specific meaning to the communicative partner they were recorded as verbalisations. Lastly, when the child handed a picture symbol to a communicative partner it was recorded as a PECS exchange.

Observations in the home took place after school, when the children were having afternoon tea and playing. Observations at school occurred during a period of free choice activities, and at morning teatime. Observations occurred for a twenty-minute duration, three times a week at school, and once a week in each of the children's homes. Two observers independently coded 25% of the observations in order to measure inter-observer agreement. The independent observer was trained by studying written definitions of the communication categories. Examples of different initiations were also presented to them for practice and they were to say which category it would go under and whether it was successful or otherwise. This continued until they were categorising the examples quickly and accurately (according to the definitions). Some of the independent observations were made via video recordings of the participants, and others involved the independent observer sitting in on the classroom and home activities during the observation periods. When both observers were recording in the classroom or home at the same time, they placed themselves at least half a metre apart to avoid cueing one-another.

At the completion of the PECS training, the parents and teachers were also asked to fill in a small follow-up questionnaire (see Appendix D), to provide some indication of consumer satisfaction.

Training procedure

Before phase one could begin, each participant's highly preferred items had to be determined. In line with the PECS training manual (Bondy & Frost, 1994), the children completed a reinforcer assessment. This involved the participants, firstly, being presented with a number of small edibles, secondly, toys, and thirdly, toys and edibles together. When a child repeatedly attempted to grab or reach for a particular item, it was recorded as a "preferred item". The preferred item was then removed and the process continued, until ten highly preferred reinforcers had been recorded for each child. As set out in the PECS training manual, this was repeated three times to ensure consistency in responding, and therefore, reinforcer preference. Further reinforcer assessments were carried out at various stages of the childrens' training, to ensure that the reinforcers being used were still highly preferred reinforcers, and to discover new reinforcers for the children.

Each child trained with a number of different adults, as it was important for the children to learn to communicate with more than one communicative partner. Apart from the researchers, communicative partners included the teachers, teacher aides, and the school's SLTs. All of the trainers had had some training in, and understanding of PECS, they had also observed the researchers carrying out a training session. When a new trainer was introduced into a session, they started as the prompter and changed to the communicative partner later in the session. This way, they were able to observe the experienced communicative partner and be involved with prompting before entering the position of communicative partner themselves. Before beginning a training session, a quick debriefing occurred so that both adults (communicative partner and prompter) knew exactly where the child was up to in their training. The quick review helped to avoid any backward steps through over-prompting or unnecessary cueing.

The first training phase was carried out in the small room at the back of the classroom, with both the gate and door closed. Phase two began in the same manner, however, throughout this phase the door was gradually opened in order to slowly introduce the childrens' PECS training into the natural classroom environment. Initially the gate was left closed so the child could not leave and other children from the classroom could not freely enter. Later, the door and gate were both opened and the training merged into the classroom. The auditory and visual stimulation had varying effects on the three children so the merge into the classroom environment was tailored to each child individually. Jane seemed not to even notice the 'distractions' and was doing her PECS training in the classroom by the seventh session. Adam, on the other hand, was not doing his PECS training in the classroom until his sixteenth session, when he was well into the third phase of training.

Once the reinforcers had been determined, phase one training - the physical exchange - was begun. In accordance with Bondy and Frost's (1994) PECS training manual, the child was taught to pick up a picture of something they wanted (the item was in view but slightly out of reach), reach towards the communicative partner, and release the picture into the trainer's hand. As soon as the picture touched the trainer's hand, the communicative partner verbally stated the child's request and immediately gave them the requested item. As suggested by Bondy and Frost (1994) the communicative partner verbalised the request as the child would have said it, for example "I want milky bar" rather than "you want milky bar"; this way, if the child began to imitate the communicative partner's exact words, problems associated with pronoun reversal could be avoided.

The teaching process for phase one involved two trainers, one to act as the communicative partner, and the other to assist the child to carry out the physical exchange. The physical prompter also recorded each of the trials, noting down things such as prompts, cues, and reinforcers. The communicative partner was sitting directly opposite the child, within arms reach. Beside the two of them was a table with the

picture card on it (close to the child). The physical prompter either stood or sat directly behind the child, avoiding any eye contact or communication. Physical assistance and cues were gradually faded. Initially, when the child went to grab or reach for the item, the physical prompter took the child's hand, helped them pick up the card, reach towards the communicative partner and release the card into the communicative partner's outstretched hand. This was recorded as a fully assisted trial. A partially assisted trial was where the prompter just directed the child's hand towards the card or communicative partner and did not need to assist with picking the card up or releasing it. A trial was recorded as "independent" if the child needed no assistance from the prompter. The communicative partner gradually faded their hand-cue initially by moving the hand towards themself so it was not so obvious to the child. They then began to curl up their fingers and drop the hand until it was in a natural position by their side or on their lap. The hand cue was not completely faded for any of the three participants until phase two. The child was introduced to phase two when they were independently passing the card in exchange for the desired item 80% of the time. Joshua moved himself onto the next phase before reaching this 80% criterion by creating distance between himself, the card and the communicative partner. We allowed him to move away but did not shift his seat away from the card or the communicative partner until he was successful 80% of the time.

Phase two - expanding spontaneity, introduced an element of distance between the child and both the communicative partner and the picture card. The distances between the child, the picture card, and the trainer, were gradually increased so that the child learned to be persistent with their communicative efforts. Initially, the communicative partner began to slowly shuffle their seat back, away from the child and the table with the card on it. Between the trials, the communicative partner would discreetly move away, only about an inch or two at a time. The communicative partner would only move if the child had independently passed the card in the *closer* position. As in phase one, this stage was taught with the help of physical guidance by one trainer, and once again, the guidance was gradually faded out. None of the children ever needed more than partial assistance during this phase of training. The communicative partner continued to move their chair

away from the child and the card, until there was about a metre between them, and the child needed to stand up in order to give them the card.

At this stage, the communication folder was introduced. The card was attached to the cover of the communication folder; the rest of the folder was empty. The children then had to remove the card from the folder in order to hand it to the communicative partner. The folder (with the card attached) was then moved away from the child on the table, forcing them to reach for it. Once the card was just in the child's reach, their chair was also gradually moved away from the table. They then had to stand up, move to the table to get the card and walk to the communicative partner to put it in their hand. When the child had mastered this, the communicative partner gradually began to stand up and move around the room. When this proved not to be a problem for the child, the communicative partner started to look away and stand with their back to the child, or pretend they were interested in something else in the room. This way, the child had to be very persistent in their communication, getting the communicative partner's attention and asking for the available item by forcing the card into their hand. As in phase one, the child was instantly and consistently reinforced with the desired item and their request was verbalised. Once again, the children were not moved onto phase three until they were independently approaching the card and bringing it to the communicative partner 80% of the time. In addition, each child was to have used at least eight different card symbols throughout the first two phases, before advancing onto phase three.

During the third phase - picture discrimination, the children learnt to discriminate between different picture symbols and understand their symbolic value. Adam was the only child to master this stage of training in the time available. He introduced himself to this phase of training by independently opening his folder during a training session and selecting a card from inside, rather than using the one that was made available to him on top of the folder. A correspondence check verified that he was aware of the item he had requested, hence, Adam's phase three training was a little different. Jane and Joshua however, were introduced to this phase very gradually, as suggested by Bondy and Frost (1992, 1994, 1995, 1996). At the beginning of phase three, a blank "distractor" card was

added alongside a card displaying the symbol of a highly preferred item. If the blank card was chosen the communicative partner responded with "I want nothing!" and held out empty hands. They would also correct the child's error by pointing to or picking up the correct card and saying something like "if you want chocolate, ask for chocolate". The amount of language used was kept to a minimum. The cards were then shifted around on the folder in preparation for the next trial. When the child was consistently passing the correct card (8 to 10 times in a row) the blank card was replaced with a card symbolising a non-preferred item such as a laundry scoop. Once again, if the child selected the wrong card, the communicative partner would pass the child the item they asked for and say, for example, "I want scoop". Error correction was used whenever the child selected the wrong card, and the cards were rearranged after most of the trials so that the child would not continuously go back to the same location on the board, rather than looking at the cards. If the child made a number of errors in a row and chose the non-preferred card over and over, the non-preferred card was switched back to the blank card. This reduced the child's error rate and prevented them from getting overly frustrated, thus maintaining their participation.

The childrens' understanding of the meanings of the different pictures was tested using correspondence checks. When the child handed the communicative partner a picture symbol, the communicative partner would verbally state the child's request as usual. However, instead of handing them what they had asked for, the communicative partner held out the items that matched the cards available and said "take it". If the child took the item s/he had requested and not another item, the correspondence was recorded as correct. The recordings were made either by the communicative partner or a second person, also occasionally acting as the physical prompter (prompting was generally not necessary at this stage). Whenever possible, two adults were present during training so that the communicative partner could concentrate on that role and did not have to record as well. In addition to recording any errors in discrimination, the number and nature of the cards available to the child and the child's selections were also recorded. These recordings helped the researchers determine when it was appropriate to move the child on to the next stage of training, and in some cases, when it was necessary to hold the child

back, or change the training approach. An independent observer recorded 25% of the phase three training observations. Special recording sheets made the recording process very simple, and little training was necessary. The recording process was explained to the independent observer and he followed the recording process during one training session, before doing the recording himself.

During the initial stage of phase three, that of preferred versus non-preferred items, Jane and Joshua were choosing the correct symbol little more than chance would predict, so some of the strategies suggested by Bondy and Frost (1994) were used. The "distractor" card was made to look very different from the correct picture, e.g., it was made very dark in comparison, or the correct picture was coloured. In addition, the correct cards were enlarged to twice the size of the distractor cards. Photographs of specific desired items, such as "Barney yoghurt" and "Cheezles", were also introduced.

The discrimination phase was taught with the communicative partner and cards in close proximity to the child. This was the case for all three children at the beginning of phase three, and Adam was the only child to combine the second and third phase, with distance and discrimination. Adam was verbally labelling most of the cards as he passed them to the communicative partner during phase two, and correspondence checks showed that he understood what he was asking for. Therefore, it was not necessary to go through the initial stages of phase three. To begin with, Adam was presented with two preferred-item cards on the folder and this gradually progressed until he could select a desired item from all of the pictures throughout his communication folder. Correspondence checks continued right throughout all of the childrens' phase three training.

All of the teachers and teacher aides involved with the children in the classroom were kept up to date on the childrens' progress in the training sessions. They were taught exactly how to respond when a child passed them a card, so that the responses were consistent and the child knew what to expect. The teachers and teacher aides were informed about the importance of the communication folders being readily available to the children, and were encouraged to create as many opportunities as possible throughout

the day for the children to use their PECS. A formal meeting involving the classroom teachers, the SLT and the researchers was held mid-way through the training to discuss the PECS proceedings and ensure that everyone was happy with them. Topics discussed in the meeting included the possibility of altering the layout of the classrooms to better accommodate the children using PECS during morning tea and lunch. The importance of parent involvement and the potential for a PECS training evening for the parents was discussed, and lastly, that teaching these children functional communication skills should take priority over many other "academic" activities.

In order for the training to transfer across settings, from the school into the home, the childrens' parents and guardians were also kept informed about their child's training. The researchers briefed the parents on their child's progress at least once a week and any queries they had were addressed. As with the teachers and teacher aides at school, the parents were taught how to respond to their child when they communicated using PECS. This way, the communicative partners' responses could be consistent in training and at school and home.

Inter-observer agreement

Values for inter-observer agreements were calculated by dividing the number of agreements by the number of agreements plus disagreements, then multiplying the result by 100. For the recordings made during the phase three training sessions, the average inter-observer agreement for error rates was 99%, the range was 86% to 100%. For the observations made outside of training, in the classrooms and homes, the inter-observer agreement ranged from 75% to 100%. On average, the agreement between observers was 98.5%. The scores in the lower end of the range for the inter-observer agreement figures were due to low frequency of the recorded behaviour. In many cases, both observers made no recordings over the entire observation period, because the child was not attempting to initiate any communication, successful or otherwise.

RESULTS

The results section has been divided into three categories. The first is the training session results, where the progression of each child through the various stages of PECS training is reported. Second, is results indicating the transfer of the PECS training into the natural classroom and home settings. Finally, the parent and teacher questionnaire results are reported and their consistency with the researcher's observations is considered.

Training Sessions

Information recorded in the childrens' training sessions is presented in table format in Appendix F. The participants took between 1 1/2 and 3 PECS training sessions to meet the 80% success rate, in order to move from the first onto the second phase of training. Adam only had 4 phase two sessions, before progressing onto the discrimination phase. Joshua and Jane spent 8 1/2 and 11 sessions, respectively, being trained in phase two. By this stage, the communicative partners were using no hand cues; these were eliminated within six days for all three participants.

Adam was successfully discriminating between two highly preferred card symbols by the end of his first discrimination training session. After that, it was just a matter of increasing the number of cards available for him to choose from. He was trained with three cards available at a time, for about five training sessions, until he was consistently passing the correct cards with no prompting. Correspondence checks were used throughout to ensure that Adam was correctly discriminating between picture cards. The number of cards available quickly rose to six cards. By day twenty-five of Adam's training, he was correctly discriminating between fifteen and twenty different cards throughout his folder. The cards were continuously being shifted around inside and on top of his folder, so that he had to scan the folder in order to find the card he was after. In the early stages of Adam's training, he would verbally label about half of the cards as he passed them to the communicative partner. Nearing the end of his training (in the last 10 sessions), Adam was labelling the cards as he passed them, on average, 96% of the time.

In the last three sessions of Phase two Jane was independently walking to the folder, removing the card, approaching the communicative partner, and putting the card in their hand 100% of the time. During these last days of phase two, training focused on building up the number of different reinforcers she was asking for. Jane did not progress past having any more than two cards available for her to choose from at any one time. Jane's error rate for sessions involving a highly preferred card and a blank card was between 6% and 25%. In the sessions where a highly preferred card was paired with a non-preferred item card on some trials and a blank card on others, the error rate rose to between 12% and 38%. Another strategy, making the highly preferred cards larger, was introduced in the twenty-sixth training session and was used for the last four sessions. When one of these larger cards were paired with a blank card, Jane's error rates were still very high, between 13% and 48%. However, she was showing rapid improvement. Her error rate reduced from 15 errors (in 31 trials) on the first day to just 8 errors (in 27 trials) on the second and only 2 errors (over 16 trials) on the third day of training with the larger cards.

Joshua progressed steadily through phases one and two. By the beginning of his thirteenth session Joshua was ready to begin phase three. He was independently passing the cards 100% of the time, with distance between himself, the card and the communicative partner. By the end of his training, Joshua was able to select a highly preferred card when it was presented on the folder with a blank card and one other. Joshua began his phase three training as Jane did, with one highly preferred card and a blank card available. His error rate for these trials was between 3% and 16%. When the error rates got to the low end of the scale, the blank card was replaced with a non-preferred card. Joshua had six sessions where a highly preferred card was paired either with a non-preferred card or a blank card. His error rates for these sessions were between 11% and 27%. There was no real downward trend apparent in Joshua's error rates over these sessions. Therefore, a new strategy was adopted, to make the preferred and non-preferred cards very different in appearance. Initially, the non-preferred cards were made very dark in comparison to the preferred cards. Over four sessions the error rate decreased to between 0% and 3%. Following this, the preferred cards were enlarged and some photographed pictures of specific items were also introduced (as large preferred

cards). The enlarged and photographed (preferred) cards were used for the last four days of Joshua's training and his error rate reduced significantly. On the first day with the larger cards he made four errors (error rate of 12%), this halved to just two errors in the following session, and in the last two sessions he made no errors at all. On top of this, in the last two sessions, Joshua was being presented with more than one preferred item card at a time, and, correspondence checks showed that he *was* taking the item that he asked for in these trials. Throughout Joshua's training he started to vocalise more often, usually saying "lollies" (one of the few words in his vocabulary prior to his PECS training), but he also began attempting new words.

Transfer of PECS Training

The general trend (as seen in Figure 1) for all three participants at school was that successful initiations of communication increased as the training went on, and unsuccessful initiations of communication decreased. Although there were only two observation sessions in Adam's baseline, the recordings did show that unsuccessful initiations of communication were at a higher level than the successful initiations. Adam's successful initiations of communication rapidly increased (with a variable trend) over the intervention period, while his unsuccessful attempts at initiating communication gradually decreased, reaching zero on the fifteenth observation session, at which point no more unsuccessful initiations were recorded. Adam was not observed to increase his successful initiations of communication in the classroom setting until the discrimination phase (phase three) of his PECS training was underway, however, there were only three observation sessions prior to this phase being introduced. Jane's baseline rates of initiating communication (both successfully and unsuccessfully) were relatively stable; however, unsuccessful initiations were at a higher level than successful initiations. Jane's successful initiations of communication gradually increased with a variable trend while her unsuccessful initiations decreased at a similar rate. Jane spent longer than Adam did being trained in phase two and was observed to increase her successful initiations of communication outside of the training setting during this phase. She also continued to increase her successful initiations while she was being trained in the third phase of PECS. Joshua's baseline spanned five observation sessions, during

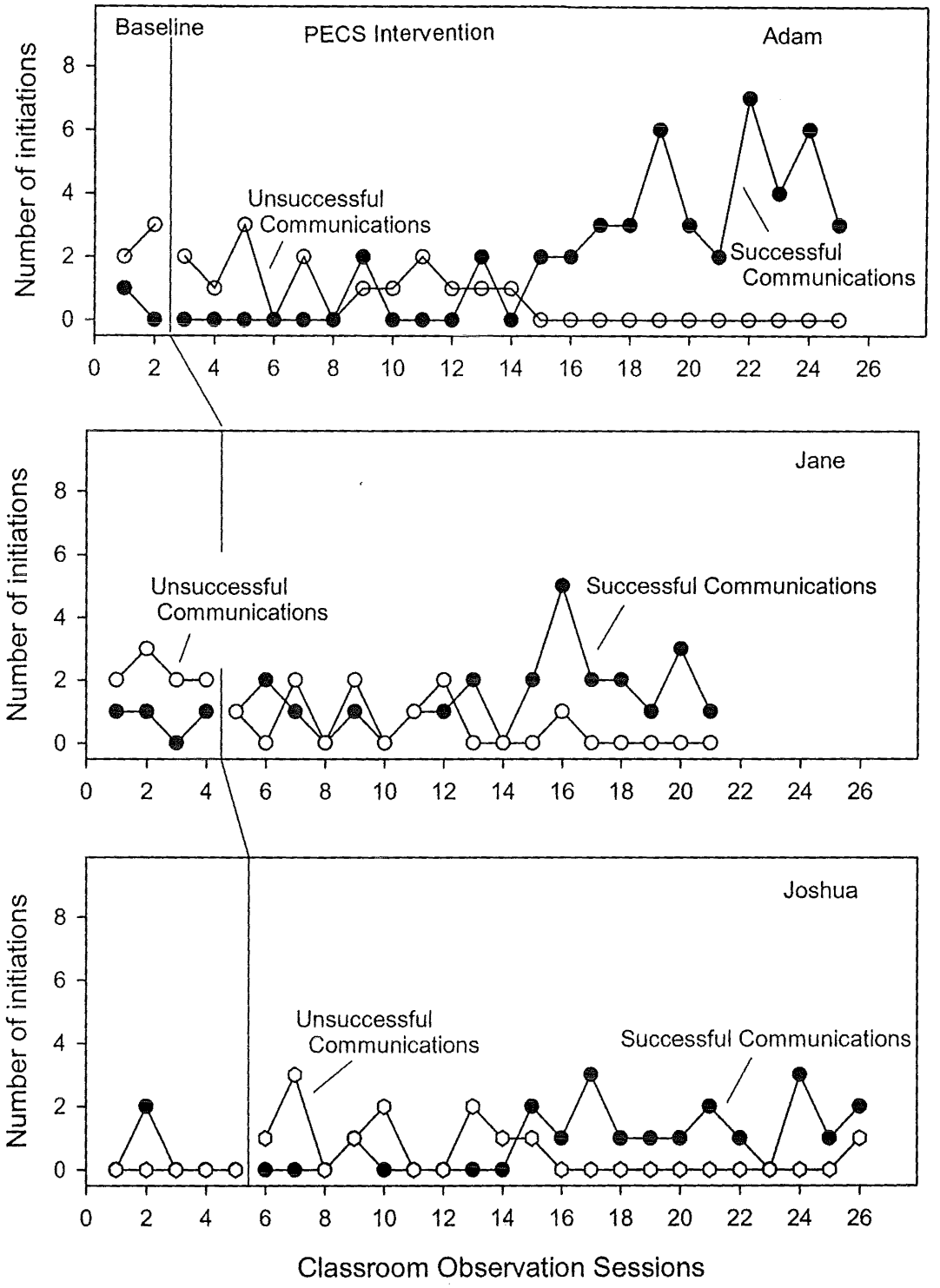

Figure 1. Total successful and unsuccessful initiations of communication, during transfer of training observation sessions at school, over the childrens' baseline and intervention periods.

these he was observed to attempt communication twice (both successful) in one session and not at all in the other four observation sessions. Over the intervention period (particularly once he had mastered the second phase of training) Joshua's successful initiations of communication gradually increased, while his unsuccessful initiations decreased at a similar rate.

The forms of communication that the children attempted to use over the baseline and intervention periods are represented in Figure 2. Only the forms of communication that were used a significant amount are reported in the graphs to avoid a cluster of data along the X-axis line [see Appendix E for tables displaying observation data for each child, at home and school]. Unsuccessful PECS exchanges are not shown in any of the graphs because they never occurred. Adam's graph shows only two different communication categories, namely successful PECS exchanges and unsuccessful vocalisations. [2] Adam's vocalisations were never recorded as successful and he only occasionally used gestures, three times in baseline (one of which was successful) and four times (one successful) in the very early stages of his intervention. Adam's graph shows that the rapid increase in successful initiations of communication over the intervention period was due to an increase in the use of PECS to communicate, and the reduction in unsuccessful initiations was largely due to a reduction in his attempts to communicate using vocalisations.

Jane never used verbalisation as a form of communication so this category was omitted from her graph. On four occasions (once in baseline) Jane attempted to communicate through vocal means (never more than once in any single observation session) but these initiations were never successful, therefore, vocalisations were also not included in Jane's graph. Jane made a total of 13 initiations of communication during baseline, 12 of them were gestural and fewer than one quarter of them were successful. The graph shows that Jane's successful initiations of communication increased as a function of her PECS use.

[2] Adam was verbalising (single words) but only when using PECS, and the teacher or other communicative partner was responding to the child as they were when he was using PECS alone (looking at the card before responding); therefore, these instances were recorded simply as PECS exchanges.

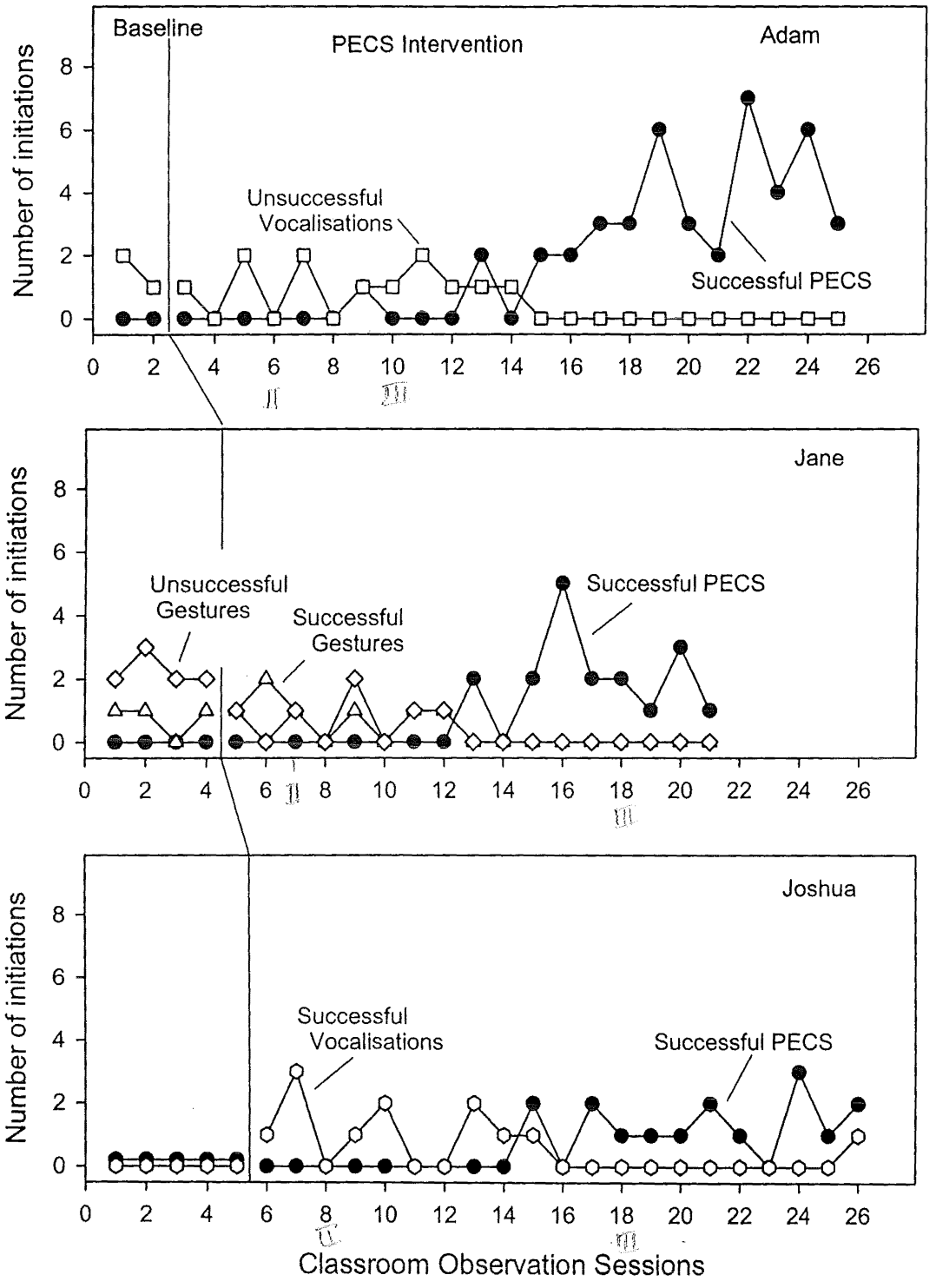

Figure 2. Forms of communication used during transfer of training observation sessions at school, and the success of these communications, over the childrens' baseline and intervention periods.

Jane's use of PECS outside of training gradually increased over the intervention period. Her use of gestures to communicate (both successfully and unsuccessfully) gradually decreased over the first half of the intervention period, and in the second half of the intervention period no further gestural communications were recorded during the observation sessions. Verbalisations and gestures were not reported in Joshua's graph as he only used each of these forms of communication twice during observations, once in baseline and once throughout the intervention period. Successful vocalisations were also not graphed as only one was recorded. The graph shows that Joshua's successful PECS exchanges gradually increased as his unsuccessful vocalisations gradually decreased. Joshua showed an increase in his rate of initiating communication as soon as the intervention was introduced, however, his early attempts at communication were generally not successful.[3]

The percentage of the total initiations of communication that were successful, as opposed to unsuccessful, rapidly increased for all three children (see Figure 3). The data is limited to observation periods where some initiations occurred. The gaps in the data presented in Figure 3 represent occasions where no attempts at communication (successful or unsuccessful) were made. For example, Joshua only attempted to initiate communication twice (both successful, and both during the same observation period) over the five baseline observation sessions. Therefore, at a glance, his success at communicating during the baseline period may appear good even though he very rarely attempted to initiate communication. When Joshua was introduced to PECS training his communication increased (although it was mostly unsuccessful), and as he learnt to communicate using PECS his success rate rapidly improved. Adam and Jane on the other hand, were both attempting to initiate communication during the baseline period, but were often not successful at it. Adam's successful initiations of communication very rapidly increased between the ninth and fifteenth observation sessions. Adam was 100%

[3] Joshua continued to use vocalisations after the 15th observation session but accompanied them with PECS; these instances were simply recorded as successful PECS exchanges, because, as with Adam's verbalisations, the communicative partners were responding as they were when Joshua used PECS alone (without accompanying vocalisations).

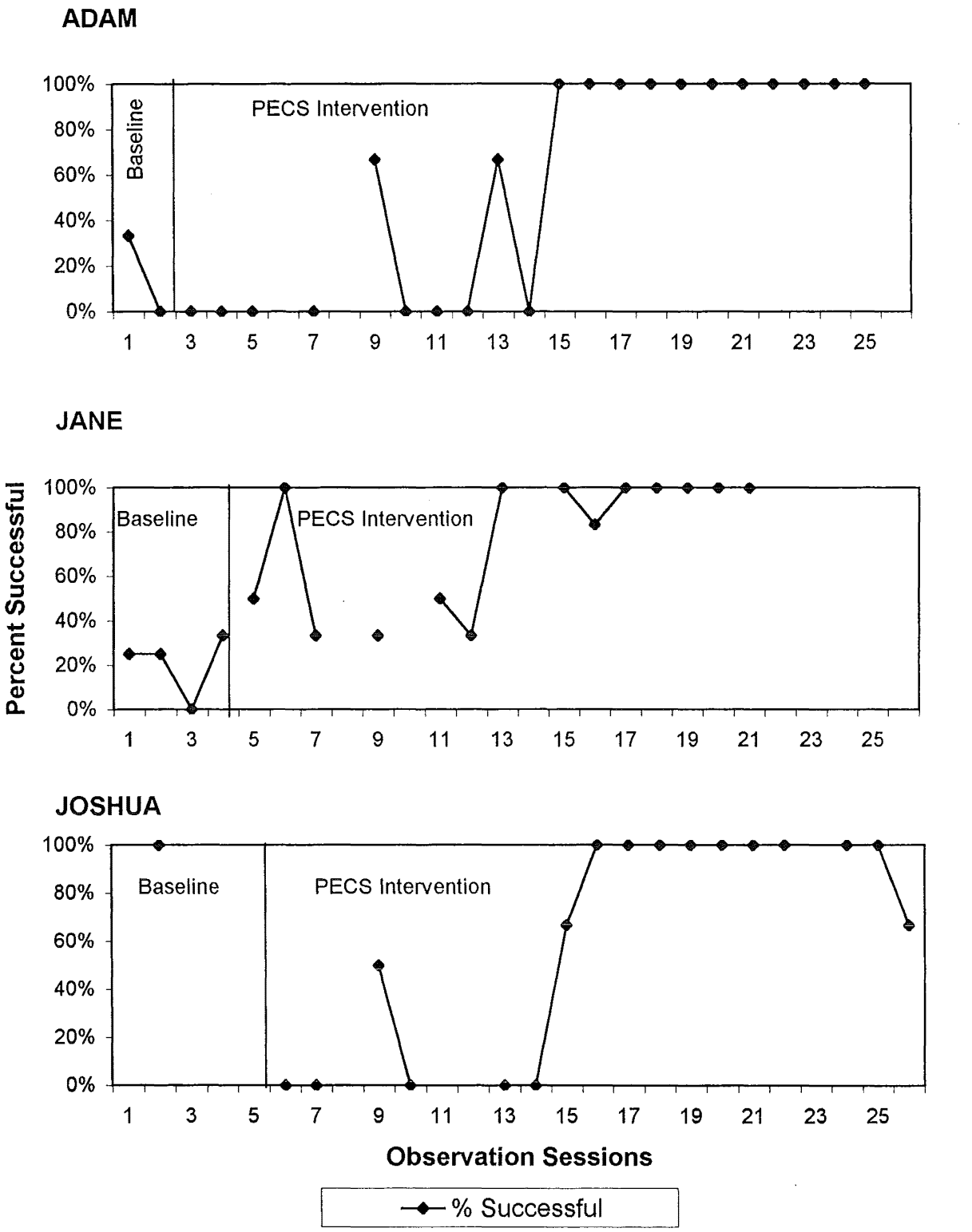

Figure 3. Percent of the total initiations of communication (recorded during observation sessions at school) that were successful, over the baseline and intervention periods.

successful in his attempts at initiating communication in every observation session from the fifteenth onward. The proportion of Jane's initiations that were successful also increased over the intervention period although not nearly as rapidly as Adam's.

Generalisation of the PECS training to the children's homes was evident but only for two of the three children (see Figure 4), and was not as strong as the generalisation to the classroom. Adam was observed using PECS at home by the fourth week of his PECS training. Throughout the intervention period he showed a steady, gradual increase in his use of PECS at home. Jane's use of PECS at home also gradually increased over the intervention period. She began using PECS to initiate communication at home in the second week of her intervention. Joshua, however, showed very little generalisation of his PECS training into his home environment. He was observed to use PECS on only one occasion with his mother at home.

Although not formally recorded, Adam was observed to increase the number of words he used when communicating via PECS in the classroom and at home. Jane showed no increase in either vocalisations or word use (verbalisations) when using PECS. Joshua was observed to increase his attempts at saying words (although these attempts were often not interpretable) when using PECS to initiate communication. However, as with the other children, this was not systematically recorded outside of the training setting.

Questionnaire Results

Results from the parent and teacher follow-up questionnaires were mixed with respect to their consistency with the researcher's observations. Comments from Adam's teacher were very positive. He was reported to be initiating communication more often and being understood far more frequently after being trained to use PECS. His teacher also reported a reduction in maladaptive behaviour (throwing objects), and noted that he was more settled in class and could sit longer at activities. Adam's parents also noted improvement in his frequency of and success in initiating communication. Contrary to the researcher's in-class observations, Jane's teacher reported that she noticed no change in Jane's level of initiating communication or in how well she could be understood. One

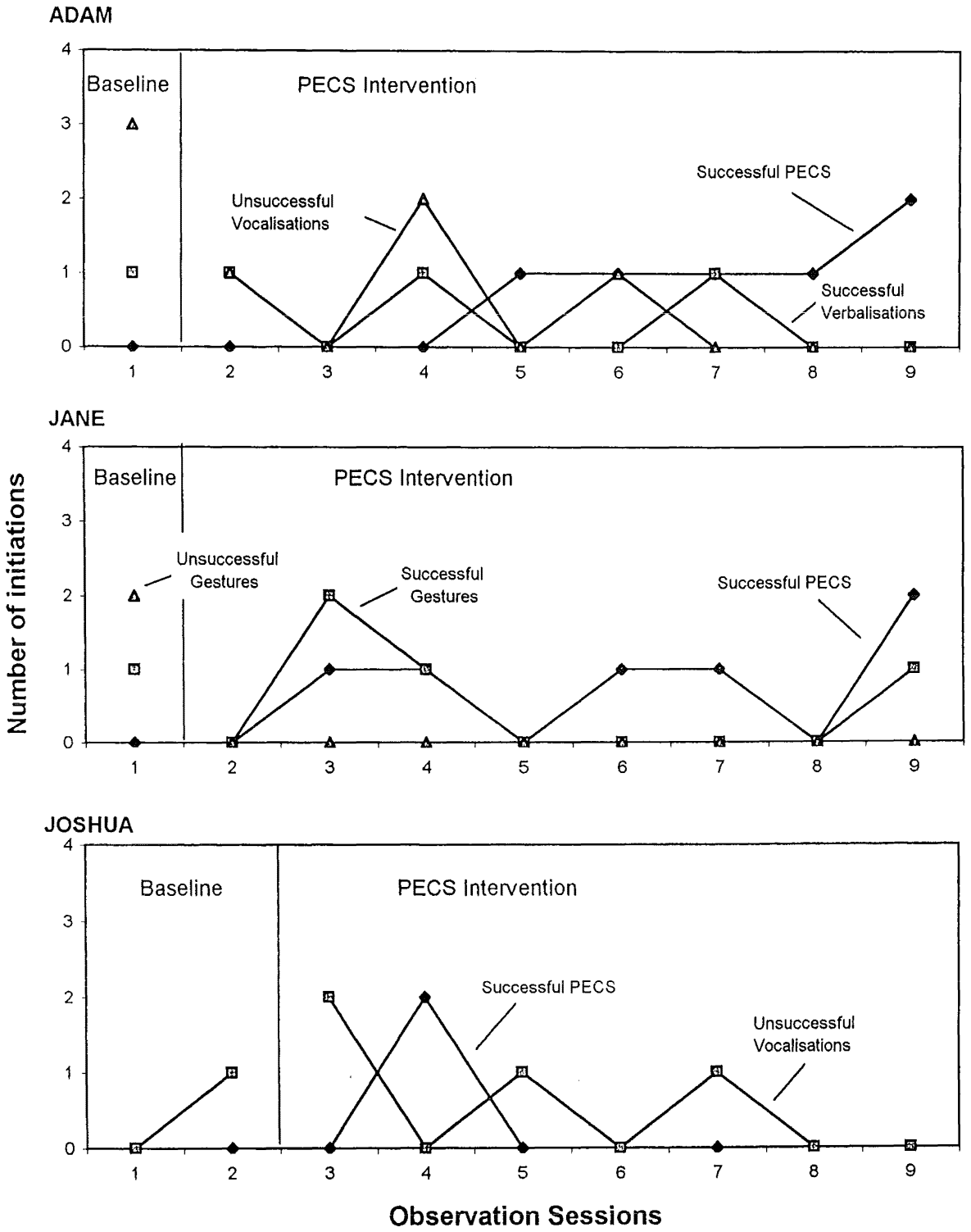

Figure 4. Total successful and unsuccessful initiations of communication, during transfer of training observation sessions in the childrens' homes, over the baseline and intervention periods.

change she did note was that Jane became less tolerant of sitting in her chair during circle and activity times. In line with the observation data, Jane's parents reported some improvement in her frequency of initiating communication at home and in their understanding of what she was trying to communicate, after her PECS training. Her parents also noted the perceived difficulty in Jane's ability to differentiate between cards and thought that simple photographs or food packaging could be used as PCS, in place of the line drawings. Joshua's teacher also perceived no change in the frequency or success of his initiating communication, even though the observation data clearly showed improvements in these areas. She did note that Joshua appeared more aware of others than he did prior to PECS training. Joshua's teacher noted that she thought he would progress more quickly using photographs as PCS rather than line drawings, as he was near the end of his training. In Joshua's parent questionnaire, his mother also wrote that she thought Joshua would relate better to more realistic picture cards such as photographs. In contrast to the researcher's observations of Joshua at home, his mother thought she noticed a slight improvement in Joshua's frequency and success of communication after his PECS training.

DISCUSSION

All three children showed increased successful initiations and decreased unsuccessful initiations of communication at school after being trained to use PECS. Adam showed a rapid increase in his successful initiations of communication while those of Jane and Joshua gradually increased. The results showed that these changes in frequency and success of communication were due to the introduction of PECS as a form of communication for the children. Other forms of communication such as Adam's (often-unsuccessful) vocalisations and Jane's gestures were replaced (or incorporated) with PECS exchanges, which were always understood by the communicative partners and thus, were always successful communications.

Training transferred into the natural classroom settings of all three children (particularly once they had mastered the distance and persistence phase of training), and generalised

into the home environments of two of the children (Adam and Jane). In order for the PECS training to generalise into the children's homes, the parents/guardians and entire family needed to be involved and support the programme. The researchers supplied the parents/guardians with all of the necessary PECS materials (appropriate cards and adhesives) so that they could be put somewhere in the home where they were easily accessible to the child. In the case of Joshua, where very little generalisation into the home occurred, the parents/guardians did not make the cards available to him in spite of the constant efforts of the researcher's to get them to do so. Adam's and Jane's parents/guardians made use of communication boards and the family fridge, as suggested by the researchers, so the cards were always available to the child when he/she was at home. These two children both used PECS at home throughout the intervention, and the observation data showed a gradually increasing trend in the frequency of their PECS use and overall success of their communicative attempts at home.

Vocalisations or word use when using PECS was not systematically recorded during the observations therefore occasions where a child vocalised whilst communicating via PECS could not be differentiated from occasions when the child used PECS alone. Hence, no solid statements can be made from this research about the effect of PECS training on the acquisition of speech or changes in a child's vocalisations. Prior research (Schwartz and Garfinkle 1998) on the acquisition of PECS in a group of children including some with autism and Down syndrome (as in the present research) reported an average of 2 months training for each of the first two phases and a further 3 months to master phase three. Schwartz and Garfinkle (1998) did report increases in word use but their observations were made over a much longer period than the present study (two years). Therefore, the children in the present study were not expected to make any great advances in their use of words to aid communication and for this reason, as noted earlier, word use and other vocalisations when using PECS were not recorded.

However, vocalisations and word use were recorded during the training sessions and two of the children, namely Adam and Joshua, used more words and vocalisations near the end of their PECS training than they did in the early stages of training. Recording the use

of words during training was not begun for Adam (the first child to begin training) until the seventh session, at which point the researchers recognised the importance of this omission and began to record both recognisable words and other vocalisations for all three participants. Any future research should record vocalisations and speech when using PECS both in training and during other observations even if such advances seem a little too optimistic (for reasons such as a short research period). Informal observations made by researchers, and reports from parents and teachers in the follow-up questionnaire, indicated that Adam increased the number of words he used when communicating via PECS at home and school. Joshua was also observed to be attempting new words and vocalising more often when using PECS as he progressed through the training. Bondy and Frost (1994) suggested that vocal imitation training and help with articulation can be introduced to children using PECS, but this training should be conducted outside of the child's PECS lessons. Adam and Joshua, in particular, might have benefited from the introduction of imitation and articulation lessons alongside the later stages of their PECS training.

The children in the present research mastered the phases of PECS training considerably faster than those in the Schwartz and Garfinkle (1998) study. They took between 1 ½ and 3 sessions to meet the criteria to move on to phase two and a further 4 to 11 sessions to master this phase in order to begin phase three. Adam even managed to master the third phase within the nine weeks of training. Joshua and Jane both showed some improvement in their discrimination skills over their phase three training, particularly near the end of their training, when the preferred cards were enlarged and in Joshua's case some of the line-drawn cards were replaced with simple photographs. Parents/guardians and teachers noted in their follow-up questionnaires, that they thought the introduction of more "realistic" PCSs such as photographs or item labels would help Joshua and Jane with discrimination. Time limitations did not allow for any extended training using photographs for Joshua (and none at all for Jane), however, Joshua did show notable improvements during his last two training sessions where photographs were used. One possible disadvantage of using photographs in place of line drawings is that the photographs are more specific to a particular object and difficulties with generalising

the pictures to other similar objects might occur. Another issue associated with the use of photographs as PCSs for PECS training is that of visual attention. The detail involved in a photograph might lead to problems, such as a child focusing on irrelevant stimuli or on background objects rather than the intended item. Further research using photographs would be necessary to investigate the effectiveness of these more realistic PCSs in training the PECS to children who have difficulty with the discrimination phase of training.

It is well documented that children with autism often show deficits in symbolic ability (Sigman & Ungerer, 1984; Wetherby & Prutting, 1984; Wetherby et al, 1998). Therefore, it should not come as a surprise that they may benefit more from more realistic PCSs (such as photographs) in their PECS training rather than trying to use line drawings, which often bear a weak resemblance to their referents. Fuller and Stratton (1991) investigated a similar issue (that of symbol representativeness) for teaching manual signs to children with autism. They found evidence that the signs bearing the strongest resemblance to their referents were less difficult, than those bearing a weaker resemblance, for the children with autism to learn and remember. Wetherby et al (1998) noted (when summing up their research findings) that communication interventions need to be tailored to each individual, based on their pre-existing communicative, social, and symbolic abilities. Hence, not every child will benefit from the use of photographs as PCSs during PECS training, but those with deficits in symbolic ability may well do so. When introducing a PECS programme, it may be beneficial to take into account the symbolic ability of the child if this information is available (e.g., through interviews, observations, testing) so as to determine whether to begin training with line-drawn PCSs or photographs. Alternatively, as in the present research, training could begin with line drawings and move on to simple photographs during the discrimination phase if the need arises.

Another possible alternative to either line drawings or photographs might be to scan photographs onto a computer and manipulate them into more simplified images. These images could be gradually altered throughout discrimination training so that they become

more like line-drawn pictures than photographs. Hence, avoiding the aforementioned possibility of problems with generalisation of a specific photographed PCS to other similar objects, as well as overcoming the issue of poor symbol representativeness with line drawn PCSs. Equally important as the *type* of picture used, is the consistency between the PCSs used in the training setting and those available for use outside of training. Also, that all parties involved, including people such as the child's teachers, parents and SLT, agree upon the type of PCSs to be used. In this way, problems with co-operation (like those faced by the present researchers in Joshua's home) might be avoided.

The baseline periods for the three participants were relatively short, but with the overall time frame being only 10 weeks the researchers thought it was important to get the first child's PECS training underway as soon as possible. In addition, there is an ethical limit to the amount of time it is appropriate to watch and record a child attempting, but continuously failing, to communicate. Furthermore, ethical problems with extended baseline periods could arise in cases where the child had behavioural problems. Carr and Durand (1985) found evidence that these disruptive behaviours may be viewed as a non-verbal means of communication for children who are unable to communicate their needs and wants in a more socially appropriate manner. Prior to his PECS training, Adam (the child with the shortest baseline period) displayed disruptive behaviours such as throwing objects. In the follow-up questionnaire, Adam's teacher reported that he was throwing objects a lot less often after his PECS training than before it. Other positive behavioural changes reported by Adam's teacher were that he appeared more settled in class and would sit longer at activities. Although Adam's maladaptive behaviours were not serious (in that he was not physically injuring himself or others) a short baseline was ideal in his case.

Unlike all of the other (published) research on the PECS, the present research was collected in an experimental manner. Baseline measures of each child's communicative behaviour were taken prior to the introduction of PECS. Therefore, the observed improvements in the children's communication could be attributed with some confidence

to the introduction of PECS rather than other variables in their lives. The present research was limited to only 10 weeks and only the first three phases of PECS could be introduced to the children in this time frame. Further research testing the validity of the later stages of PECS at extending childrens' communicative abilities is needed. Never the less, the present research did show that training children in the early stages of PECS helps to increase their success and frequency of initiating communication. Furthermore, (with the co-operation of other individuals in the childrens' lives) PECS training was shown to generalise from the training setting to other situations and environments. Positive behavioural changes similar to those reported by Bondy and Frost (1995) were also indicated in the present research although this was not systematically measured. Further research employing appropriate controls is needed to validate the claims of improved behaviour management as a result of PECS training. As in the previous PECS research reporting advancement in the use of speech as a function of PECS training, the present research did not experimentally measure this outside of the training sessions. However, vocalisation and word-use data from the training sessions was promising, and future researchers (especially those using a wider time frame) should certainly include this measurement in their observations.

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APPENDIX A

School Consent Form

- I have read the research information sheet and its attachments (taken from the PECS manual), and my questions have been answered to my satisfaction.
- I understand that three children from this school will be trained, at school, to use PECS.
- I understand that these children will need to be observed at school and that some of these observations will be recorded using video.
- I have been assured of the complete confidentiality of the research, and that the identity of the children and the school will not be disclosed in any reports of the study.
- I recognise that the University's Human Ethics Committee has approved the research.

I ..... **allow / do not allow** this research project to be carried out at my school.

Signature ..... (School Principal) ..... (Date).

Investigator's Statement:

I, Anna Firth, have discussed with ..... (School Principal) the aims of the research and the procedures involved.

Signature ..... Date .....

APPENDIX A continued...

Parent/Guardian Consent Form

- I have read the research information sheet and its attachments (taken from the PECS manual), and my questions have been answered to my satisfaction.
- I understand that my child will be trained to use PECS at school and that I will need some training in the use of PECS so that s/he can also communicate using PECS pictures at home.
- I understand that my child will need to be observed once a week at home (for 20 minutes), and that some of the observations (at school and home) will be recorded using video.
- I understand that I am free to withdraw my child from the research at any time. I also have the right to withdraw any information previously provided.
- I have been assured of the complete confidentiality of the research, and that my child's identity and school will not be disclosed in reports of the study.
- I recognise that the University's Human Ethics Committee has approved the research.

I ..... **allow / do not allow** my child to take part in this research project.

Signature ..... (Participant's parent/ guardian) ..... (Date)

Investigator's Statement:

I, Anna Firth, have discussed with ..... (Participant's parent/ guardian) the aims of the research and the procedures involved.

Signature ..... Date .....

APPENDIX B

Dear parent/ guardian,

You and your child are invited to take part in a research project concerning the effectiveness of the Picture Exchange Communication System (PECS). The attached information sheets (taken from Bondy and Frost's training manual, 1994) provide you with an outline of the PECS, what it involves, and the positive outcomes it has had on the communication of young children with autism.

The research will involve your child being trained in the use of the PECS in their classroom environment. They will be observed (at school and in the home) a number of times prior to, and during the intervention. Instances of initiating communication will be recorded with respect to the methods used and their success or otherwise. It will be necessary for your child to learn to communicate with a number of different communicative partners, in various different settings. Thus, you will be trained in the use of the PECS so that your child will be able to use the system at home as well as at school.

Although the results of the study will be submitted as part of a masters thesis and possibly published in the professional literature, you may be assured of the complete confidentiality of the research. Neither your identity, the identity of your child or other family member, nor the location of your home or the pre-school will be disclosed. Anna Firth is carrying out the research for her masters thesis in psychology at the University of Canterbury. The University's Human Ethics Committee has granted approval for the research. If you agree to have your child participate in the research programme, you and your child are free to withdraw from it at any time.

For further information, or if you have any questions please fell free to contact me (Anna Firth ph.357 2404 email: ajf70@student.canterbury.ac.nz) or one of the research supervisors (Bonny Le Grice ph. 343 7765 email: bonny.le.grice@cce.ac.nz; or Neville Blampied ph. 364 2987 Ext. 6199 email: n.blampied@psyc.canterbury.ac.nz).

APPENDIX B continued...

Pyramid Educational Consultants, Inc.
Andrew S. Bondy, Ph.D.
Lori A. Frost, M.S., CCC/SLP
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The Picture Exchange Communication System (PECS)

A Parent/Staff Handout

Children with autism, especially very young children, often have great difficulty using language to express themselves. Up to 80% of children with autism entering the public school 5 years and younger, do not display any useful speech. For these children, and others who may have some speech but rarely use it to their advantage, intense and highly structured interventions are necessary if useful language ever is to develop. Another major difficulty faced by young children with autism is how they react to social situations. These children rarely begin (initiate) an interaction with adults and usually do not maintain an interaction that is started by adults. Of course, most of our social interactions involve language, so these children are presented with double trouble.

Many parents and professionals have attempted to teach their silent children to speak. Such training often starts with trying to teach the child to look at the adult's face or eyes. Even when this type of teaching works, it takes many weeks, if not many months. After this time, the child then is taught to make various sounds and eventually to imitate these sounds. This step also takes a long time. Finally, the child is taught to blend the sounds into words- words often selected by adults. During all of this teaching time, the child continues to have no useful and calm way to communicate with other people.

Some people have tried ALTERNATIVE communication systems- that is, communication styles that do not involve speech. Sign language is one such system and so too is the use of pictures and other visual symbols. Several factors contribute to making these systems fairly slow to acquire. For example, sign language involves imitation- something that is not easy for children with autism. Picture systems (up until now) have involved POINTING to pictures. However, pointing often is confusing to the child and the adult because the child does not always get the adult's attention, or look at what the picture is a picture of, or the child repeatedly taps at one or more pictures.

We developed the Picture-Exchange Communication System (PECS) because of our difficulty over many years worth of trying other communication training programs (Bondy & Frost, 1994). The system has been used with over 85 children in Delaware who were 5 years or younger and did not use speech when they entered school. Of the 66 children who have used PECS for more than one year, 44 now use independent speech and an additional 14 use speech augmented by picture (or written word) systems. Seven of these children are no longer educationally identified as autistic and over 30 have been placed in classrooms for children with mild handicaps. Teachers enthusiastically endorse and use the system, and parents have used the system at home and in the community. PECS is very rapidly acquired; many children learn the fundamental exchange in the first day of training. One important aspect of PECS is that the children are the initiators- they are the ones to start an interaction. They do not learn to wait or depend upon adults to communicate. They immediately express their needs to adults who can meet those needs. Learning PECS also has had a dramatic effect upon reducing the behavior management concerns of these children at school and at home.

APPENDIX B continued...

PECS begins by finding out what things a child is attracted to– that is, what things a child wants. These items may be food, drink, toys, books, or anything that the child consistently reaches for and takes hold of. After the adult (teacher or parent) knows what a child wants by having watched the child, then a picture (color photograph or black-and-white line drawing) is made of the object. Let's assume the child likes raisins. While the child is reaching for a raisin, one trainer physically helps the child pick up the picture of the raisin and put it into the open hand of the other trainer- the one who has the raisin. As soon as the picture is placed in the hand, the trainer says "OH, you want a raisin!" (or something similar) and immediately gives a raisin to the child. The child is NOT asked what he or she wants. The child is NOT told to pick up the picture. The trainer says NOTHING until the child has put the picture into an open hand. Slowly, over time, the physical help to pick up the picture is dropped, as is the help in putting it into the other trainer's hand. Over several interactions, the child starts the interaction by picking up the picture and giving it to a trainer.

The next step involves having the trainer move away from the child so that the child must put in some effort to get to the trainer. Several people should now be involved in receiving pictures- but only for raisins at this point! After the child is taught to use one picture with several people, then more pictures are added about other things that the child wants. However, at this point, the child is presented with only one picture at a time. After some time at being able to use several pictures, one by one, then the trainer can put two pictures on a board, followed by three, four, etc.

A child using the system at this point, while seemingly doing only a few things, has really learned some extremely important skills. When the child wants something, he or she will go to the picture board, pull off a picture, find an adult, go to the adult, put a picture into the adult's hand and wait to receive what was requested. The child calmly goes to an adult to get something instead of trying to obtain the object while ignoring other people. The importance of the child INITIATING the interaction cannot be over stressed. The child is NOT dependent upon adults.

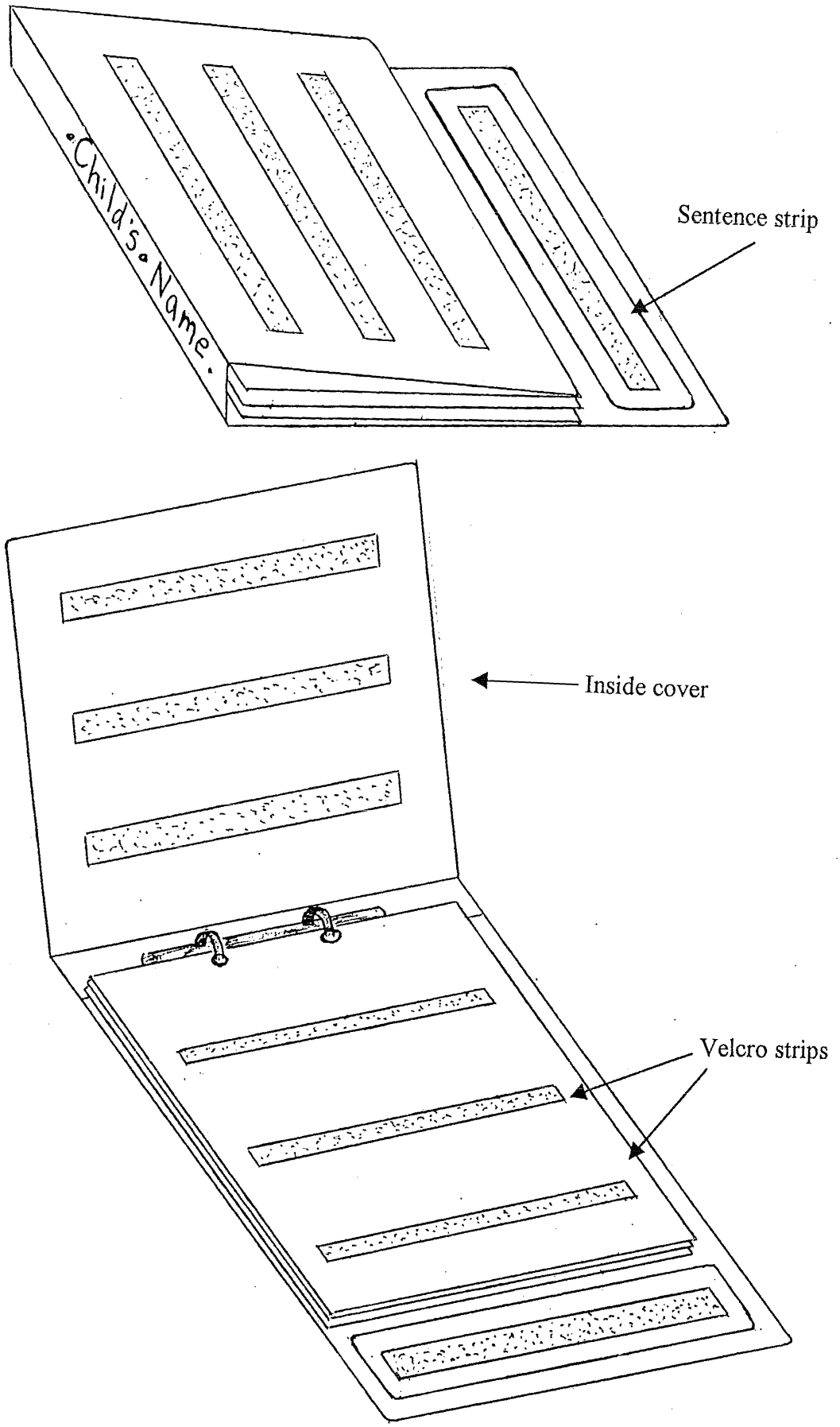
The PECS system next teaches the child to create simple sentences, such as "I want"..."cookie" using several pictures and a "sentence strip." The child must still hand the sentence to an adult. The PECS system next teaches the child the difference between requesting and simple comments, such as "I have" or "I see" or "There's a." For some children, this step is a difficult one and may require some "fine tuning." PECS continues with expanding the number of pictures per sentence and the number of concepts that the child can communicate about. In our experience, children who use 50 to 100 pictures often start to speak while handing over the pictures. (Some children start to speak much earlier while some children may continue to rely upon the pictures.)

We have been very excited about the dramatic success we have seen with children taught to use PECS. We have controlled studies supporting the use of PECS in many states across America, in South America and Canada, with very young children through adults, and with children with autism and other severe communication handicaps. All children we have worked with in Delaware and New Jersey have learned at least the first aspect of PECS-- exchanging a single picture (or other visual representation) for a desired item. A very high proportion of these children learn to speak within a year or two of starting on PECS.

PECS is easy to learn to use by teachers, other staff, and parents. It does not involve complex materials or highly technical training. It does not involve expensive equipment, comprehensive testing, or costly staff or parent training. It is useful within a classroom, or in a home, or out in the community. Children who have learned other communication systems have rapidly switched to PECS and expanded their communication skills. Children on PECS are highly motivated to learn the system because they get exactly what they want. We understand that for very young children with autism, they are not usually trying to make us happy and pleased with their accomplishments. Through PECS, they can learn the importance of having other people help them and can learn to count on people responding to their calmly delivered messages. With the correct system and the proper training, a picture is certainly worth a thousand words!!

APPENDIX C

Diagrams of PECS folder:

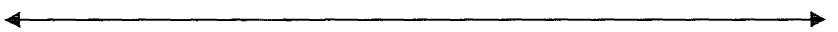


APPENDIX D

Parent/ Teacher Follow-up Questionnaire

1. I understand what my child/ student is trying to communicate more easily than before s/he was trained to use PECS.

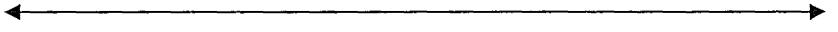
1 2 3 4 5 6 7



Strongly Disagree *Strongly Agree*

2. My child/ student initiates communication more often now, than s/he did prior to PECS training.

1 2 3 4 5 6 7



Strongly Disagree *Strongly Agree*

3. Please note any other changes you noticed in your child/ student after the three months of PECS training and use (e.g. behavioural changes).

_____

_____

_____

4. Please note any changes that you think would improve the PECS programme.

_____

_____

_____

APPENDIX E

Key for Appendix E

F = Fully assisted trial	# cards = Number of cards used in session
P = Partially assisted trial	# available = Number of cards available at a time
I = Independent trial	C/ Check = Correspondence check
% Indep. = % Independent	NC = Non compliant
H/C = Hand cue	e = Errors (blank C/Check = 0 e)
V = Vocalisation	CP = Communicative partner

Adam's PECS Training

Day	Phase	F	P	I	Word	Trials	% Indep.	H/C	# cards	# available	C/Check	Notes
1	1	6	10	44	?	20	40%	Yes	2	1		
2	1	0	8	40	?	16	69%	Fading	2	1		
3	1 & 2	0	2	58	?	20	90%	Fading	3	1		
4	2	0	5	46	?	17	76%	Fading	3	1		
5	2	0	1	44	?	15	93%	Fading	3	1		
6	2	6	2	16	?	8	63%	Fading	2	1		NC
7	2 & 3	0	4	35	9	13	69%	No	3	1		
8	3	0	2	46	9	16	94%	No	3	1 or 2		
9	3	1	3	14	4	6	50%	No	3	2 or 3		NC
10	3	0	0	15	5	5	100%	No	2	2 or 3		Limited time
11	3	0	2	58	18	20	90%	No	3	2 or 3		
12	3	0	2	52	11	18	94%	No	5	2 or 3		
13	3	0	0	78	17	26	100%	No	4	2 or 3		Gate closed
14	3	0	0	78	19	26	100%	No	3	2 or 3		
15	3	0	0	33	6	11	100%	No	3	2 or 3		NC after 11
16	3	0	0	36	12	12	100%	No	4	3, 4 or 5		Classroom
17	3	0	0	93	23	31	100%	No	4	4 or 5		Classroom
18	3	0	0	30	4	10	100%	No	4	5		NC after 10
19	3	0	0	45	9	15	100%	No	4	5 or 6		
20	3	0	0	30	5	10	100%	No	3	5 or 6		NC after 10
21	3	0	0	57	14	19	100%	No	6	5 or 6		Less preferred
22	3	0	0	90	30	30	100%	No	4	4		Only activities
23	3	0	0	99	29	33	100%	No	4	6		Activities + food
24	3	0	0	90	28	30	100%	No	4	5		Activities + food
25	3	0	0	63	21	21	100%	No	6	folder (15-20)		Walking around
26	3	0	0	54	18	18	100%	No	5	whole folder		Walking around
27	3	0	0	36	11	12	100%	No	5	whole folder		Got irritable
28	3	0	0	30	8	10	100%	No	5	whole folder		Distracted
29	3	0	0	30	10	10	100%	No	2	whole folder		NC w. activity
30	3	0	0	111	34	37	100%	No	4	whole folder		New activity.
31	3	0	0	48	16	16	100%	No	3	whole folder		Walking around
32	3	0	0	78	26	26	100%	No	3	whole folder		Giving string back!
33	3	0	0	69	23	23	100%	No	3	whole folder		Knows the drill

APPENDIX E continued...

Jane's PECS Training												
Day	Phase	F	P	I	Word	Trials	% Indep.	H/C	# cards	# available	C/Check	Notes
1	1	0	6	45	0	17	88%	Yes	2	1		small room
2	1 & 2	0	13	56	0	23	61%	Yes	3	1		small room
3	2	0	2	91	0	31	94%	Fading	4	1		small room
4	2	4	2	48	0	18	83%	No	4	1		small room
5	2	0	5	34	0	13	69%	No	4	1		small room
6	2	0	0	63	0	21	100%	No	4	1		small room
7	2	0	3	30	0	11	82%	No	4	1		classroom
8	2	0	1	44	0	15	93%	No	4	1		classroom
9	2	0	0	45	0	15	100%	No	3	1		classroom
10	2	0	1	41	0	14	93%	No	3	1		classroom
11	2	0	0	42	0	14	100%	No	2	1		classroom
12	2	0	0	78	0	26	100%	No	2	1 or 2		morning tea
13	2	0	0	39	0	13	100%	No	1	1		classroom
14	3	0	3	60	0	21	86%	No	3	2	2 e(10%)	using blank
15	3	0	0	90	0	30	100%	No	4	2	7 e(23%)	blank & scoop
16	3	0	0	123	0	41	100%	No	6	2	5 e(12%)	blank & scoop
17	3	0	0	78	0	26	100%	No	2	2	2 e(8%)	just blank
18	3	0	6	144	0	50	98%	No	3	2	19 e(38%)	blank & scoop
19	3	0	3	54	0	20	90%	No	2	2	3 e(15%)	just blank
20	3	0	0	72	0	24	100%	No	3	2	5 e(21%)	just blank
21	3	0	0	81	0	27	100%	No	3	2	6 e(22%)	blank & scoop
22	3	0	0	48	0	16	100%	No	2	2	1 e(6%)	just blank
23	3	0	0	108	0	36	100%	No	3	2 or 3	7 e(19%)	just blank
24	3	0	0	27	0	9	100%	No	2	2	1 e(11%)	just blank
25	3	0	0	60	0	20	100%	No	2	2	5 e(25%)	just blank
26	3	0	0	63	0	21	100%	No	2	1 or 2	5 e(24%)	Int. BIG cards
27	3	0	0	93	0	31	100%	No	2	2	15 e(48%)	BIG card + blank
28	3	0	0	81	0	27	100%	No	4	1 or 2	8 e(30%)	
29	3	0	0	48	0	16	100%	No	2	1 or 2	2 e(13%)	out of chair

APPENDIX E continued...

Joshua's PECS Training												
Day	Phase	F	P	I	Word	Trials	% Indep.	H/C	# cards	# available	C/Check	Notes
1	1	5	8	32	1	16	50%	Yes	2	1		
2	1 & 2	12	11	52	4	29	48%	Fading	2	1		
3	2	0	11	61	4	24	63%	Fading	2	1		
4	2	0	0	78	0 (11V)	26	100%	Fading	2	1		
5	2	0	2	64	15 (1V)	22	91%	No	4	1		CP standing
6	2	0	1	53	11 (4V)	18	94%	No	3	1		
7	2	0	0	60	2 (1V)	20	100%	No	4	1		Door open
8	2	0	2	67	20 (2V)	23	91%	No	4	1		Gate closed
9	2	0	5	73	12 (3V)	26	81%	No	2	1		
10	2	0	1	99	3 (9V)	33	97%	No	3	1		
11	2	0	5	79	9 (6V)	28	89%	No	5	1		Gate 1/2 open
12	2 & 3	0	1	92	15 (1V)	31	97%	No	2	1 & 2	2 e(13%)	In classroom
13	3	0	0	126	13 (20V)	50	100%	No	4	2	8 e(16%)	Blank card
14	3	0	0	99	6 (11V)	34	100%	No	2	2	1 e(3%)	Blank card
15	3	0	0	90	19 (4V)	30	100%	No	3	2	8 e(27%)	Blank & scoop
16	3	0	0	111	16	37	100%	No	4	2	6 e(16%)	Blank & scoop
17	3	0	0	72	8	24	100%	No	6	2	3 e(13%)	Blank & scoop
18	3	0	0	105	8 (2V)	35	100%	No	3	2	9 e(26%)	Blank & scoop
19	3	0	0	99	4	33	100%	No	2	2 or 3	6 e(18%)	Blank & scoop
20	3	0	0	105	18	35	100%	No	2	2	4 e(11%)	Blank & scoop
21	3	0	0	84	10 (1V)	28	100%	No	3	2 or 3	0 e(0%)	Blank & dark
22	3	0	0	108	17	36	100%	No	3	2	1 e(3%)	Bl, dark & scoop
23	3	0	0	9	3	3	100%	No	3	2 or 3	0 e(0%)	Distracted
24	3	0	0	105	7 (1V)	35	100%	No	2	2	1 e(3%)	Blank & dark
25	3	0	0	99	3 (13V)	33	100%	No	2	2	4 e(12%)	Intro. BIG JB
26	3	0	0	84	4 (8V)	28	100%	No	3	2 or 3	2 e(7%)	Variety + blank
27	3	0	1	105	13	35	99%	No	3	2	0 e(0%)	2 preferred
28	3	0	0	90	7	30	100%	No	4	2 or 3	0 e(0%)	3 preferred

APPENDIX F

Adam - School

		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline	*8-Oct*	*0*	*2*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*2*
	9-Oct	*0*	*1*	*0*	*2*	*0*	*0*	*0*	*0*	*0*	*3*
Intervention	11-Oct	0	1	0	1	0	0	0	0	0	2
	15-Oct	0	0	0	1	0	0	0	0	0	1
	16-Oct	0	2	0	1	0	0	0	0	0	3
	18-Oct	0	0	0	0	0	0	0	0	0	0
	29-Oct	0	2	0	0	0	0	0	0	0	2
	30-Oct	0	0	0	0	0	0	0	0	0	0
	1-Nov	0	1	1	0	0	0	1	0	2	1
	5-Nov	0	1	0	0	0	0	0	0	0	1
	7-Nov	0	2	0	0	0	0	0	0	0	2
	8-Nov	0	1	0	0	0	0	0	0	0	1
	12-Nov	0	1	0	0	0	0	2	0	2	1
	14-Nov	0	1	0	0	0	0	0	0	0	1
	15-Nov	0	0	0	0	0	0	2	0	2	0
	19-Nov	0	0	0	0	0	0	2	0	2	0
	20-Nov	0	0	0	0	0	0	3	0	3	0
	21-Nov	0	0	0	0	0	0	3	0	3	0
	26-Nov	0	0	0	0	0	0	6	0	6	0
	27-Nov	0	0	0	0	0	0	3	0	3	0
	28-Nov	0	0	0	0	0	0	2	0	2	0
	3-Dec	0	0	0	0	0	0	7	0	7	0
	5-Dec	0	0	0	0	0	0	4	0	4	0
	11-Dec	0	0	0	0	0	0	6	0	6	0
	12-Dec	0	0	0	0	0	0	3	0	3	0

Adam - Home

		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline	*8-Oct*	*0*	*3*	*0*	*0*	*1*	*2*	*0*	*0*	*1*	*5*
Intervention	15-Oct	0	1	0	0	1	0	0	0	1	1
	29-Oct	0	0	0	0	0	0	0	0	0	0
	5-Nov	0	2	0	0	1	0	0	0	1	2
	12-Nov	0	0	0	0	0	0	1	0	1	0
	19-Nov	0	1	0	0	0	0	1	0	1	1
	26-Nov	0	0	0	0	1	0	1	0	2	0
	3-Dec	0	0	0	0	0	0	1	0	1	0
	10-Dec	0	0	0	0	0	0	2	0	2	0

KEY: **S = Successful**

US = Unsuccessful

APPENDIX F continued…

Jane - School											
		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline 1	*8-Oct*	*0*	*1*	*1*	*2*	*0*	*0*	*0*	*0*	*1*	*3*
2	*9-Oct*	*0*	*0*	*1*	*3*	*0*	*0*	*0*	*0*	*1*	*3*
3	*11-Oct*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*0*	*0*	*2*
4	*15-Oct*	*0*	*0*	*1*	*2*	*0*	*0*	*0*	*0*	*1*	*2*
Intervention 5	18-Oct	0	0	1	1	0	0	0	0	1	1
6	23-Oct	0	0	2	0	0	0	0	0	2	0
7	25-Oct	0	1	1	1	0	0	0	0	1	2
8	29-Oct	0	0	0	0	0	0	0	0	0	0
9	30-Oct	0	0	1	2	0	0	0	0	1	2
10	5-Nov	0	0	0	0	0	0	0	0	0	0
11	8-Nov	0	0	1	1	0	0	0	0	1	1
12	12-Nov	0	1	1	1	0	0	0	0	1	2
13	15-Nov	0	0	0	0	0	0	2	0	2	0
14	20-Nov	0	0	0	0	0	0	0	0	0	0
15	21-Nov	0	0	0	0	0	0	2	0	2	0
16	27-Nov	0	1	0	0	0	0	5	0	5	1
17	28-Nov	0	0	0	0	0	0	2	0	2	0
18	3-Dec	0	0	0	0	0	0	2	0	2	0
19	4-Dec	0	0	0	0	0	0	1	0	1	0
20	10-Dec	0	0	0	0	0	0	3	0	3	0
21	12-Dec	0	0	0	0	0	0	1	0	1	0

Jane - Home											
		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline 3	*11-Oct*	*0*	*0*	*1*	*2*	*0*	*0*	*0*	*0*	*1*	*2*
Intervention 4	18-Oct	0	0	0	0	0	0	0	0	0	0
7	25-Oct	0	0	2	0	0	0	1	0	3	0
9 & 10	1-Nov	0	1	1	0	0	0	1	0	2	1
11	8-Nov	0	0	0	0	0	0	0	0	0	0
13	15-Nov	0	0	0	0	0	0	1	0	1	0
15 & 17	22-Nov	0	0	0	0	0	0	1	0	1	0
18 & 19	6-Dec	0	0	0	0	0	0	0	0	0	0
22	13-Dec	0	0	1	0	0	0	2	0	3	0

KEY: **S = Successful**

US = Unsuccessful

APPENDIX F continued...

Joshua - School											
		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline 1	*9-Oct*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
2	*11-Oct*	*0*	*0*	*1*	*0*	*1*	*0*	*0*	*0*	*2*	*0*
3	*15-Oct*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
4	*16-Oct*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
5	*18-Oct*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Intervention 6	23-Oct	0	1	0	0	0	0	0	0	0	1
7	25-Oct	0	3	0	0	0	0	0	0	0	3
8	29-Oct	0	0	0	0	0	0	0	0	0	0
9	30-Oct	1	1	0	0	0	0	0	0	1	1
10	1-Nov	0	2	0	0	0	0	0	0	0	2
11	5-Nov	0	0	0	0	0	0	0	0	0	0
12	7-Nov	0	0	0	0	0	0	0	0	0	0
13	8-Nov	0	2	0	0	0	0	0	0	0	2
14	12-Nov	0	1	0	0	0	0	0	0	0	1
15	14-Nov	0	1	0	0	0	0	2	0	2	1
16	15-Nov	0	0	1	0	0	0	0	0	1	0
17	19-Nov	0	0	0	0	1	0	2	0	3	0
18	20-Nov	0	0	0	0	0	0	1	0	1	0
19	21-Nov	0	0	0	0	0	0	1	0	1	0
20	26-Nov	0	0	0	0	0	0	1	0	1	0
21	27-Nov	0	0	0	0	0	0	2	0	2	0
22	28-Nov	0	0	0	0	0	0	1	0	1	0
23	3-Dec	0	0	0	0	0	0	0	0	0	0
24	5-Dec	0	0	0	0	0	0	3	0	3	0
25	11-Dec	0	0	0	0	0	0	1	0	1	0
26	12-Dec	0	1	0	0	0	0	2	0	2	1

Joshua - Home											
		Vocalisations		Gestures		Verbalisations		PECS		Total Initiations	
		S	US	S	US	S	US	S	US	S	US
Baseline 1	*9-Oct*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
4	*16-Oct*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*1*
Intervention 6	23-Oct	0	2	0	0	1	0	0	0	1	2
9	30-Oct	0	0	0	0	0	0	2	0	2	0
15	14-Nov	0	1	0	0	0	0	0	0	0	1
18	20-Nov	0	0	0	0	0	0	0	0	0	0
21	27-Nov	0	1	0	1	0	0	0	0	0	2
23	4-Dec	0	0	0	0	0	0	0	0	0	0
25	11-Dec	0	0	0	0	0	0	0	0	0	0

KEY: S = Successful

US = Unsuccessful